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# BEEKEEPING IN ALBERTA

BY

S. O. HILLERUD

Published by the direction of
HON. D. B. MULLEN
*Minister of Agriculture*

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Department of Agriculture,
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1939

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## FOREWORD

Beekeeping in Alberta is becoming more important each year. Many people who kept bees for a hobby are now commercial producers of high-grade honey, and each year production is increasing.

Successful beekeeping requires considerable technical knowledge, and it is for this purpose that "Beekeeping in Alberta" is offered to you. It is our hope that you will find this bulletin of practical use in solving the problems that face you as a beekeeper, and that you will preserve it as a reference book or pass it on to another whose interest is in this field.

J. R. SWEENEY,
Deputy Minister.

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# AN INTRODUCTION TO BEEKEEPING

THE beginner who intends to make a business of beekeeping is well advised to spend a summer working for a successful beekeeper. In no other way can he more readily discover his liking and aptitude for the work. When this is not possible, an attendance at short courses, the meetings of local beekeeping associations, visits to the Dominion Experimental Farm apiaries, and the apiaries at the Provincial Schools of Agriculture will do much toward a successful initiation. There are few lines of agriculture in which seeing how things are done aids more in actual practice.

A study of some of the books, bulletins and journals listed in the appendix will add much to the pleasure and profit of beekeeping. Methods are continually changing, and new discoveries or changes in management may make beekeeping even more profitable in your district.

**Organized Beekeeping.**—The Alberta Beekeepers' Association consists of a number of federated district associations. It holds an annual convention in the Fall or early Winter. Here recommendations relating to legislation are considered, and the problems of marketing, grading, production and other phases of beekeeping are discussed. The subjects for the various papers are suggested by the executives of the district associations.

Each district association carries on such activities as may benefit its members, i.e., purchasing bees, bees supplies and arranging field days and other similar educational features. Through their directors, who represent them on the Provincial Executive, they express themselves in regard to all matters affecting beekeeping.

## SECTION. I.

## THE BEEKEEPING REGIONS OF ALBERTA

Successful honey production in Alberta is primarily dependent on the presence of fields of sweet clover, fireweed or alfalfa within three miles of the apiary. Other minor sources are most desirable, but beekeeping has not proved profitable over a period of years when the major sources were other than those mentioned.

As might be expected, conditions vary throughout the Province, and for convenience we will roughly divide it into three regions, namely: The Northern, the Central, and the South-eastern. Within these are restricted areas, such as irrigated districts, muskegs, etc., which are of great importance.

### THE NORTHERN REGION

The northern region is bounded on the south and east by the Red Deer River, from the foothills to Red Deer; by the C.P.R. from Red Deer to Edmonton, and by North Saskatchewan from Edmonton to the inter-provincial border. It contains the only large areas, which have a native flora that will support commercial apiaries. It is marked by exceedingly irregular spring and midsummer flows. The early summer dearth makes it difficult to control swarming, and only expert beekeepers obtain consistently high averages in the absence of sweet clover. For many years, the wet and cold weather made the gathering of nectar impossible in the spring. However, the spread of sweet clover, which yields well, under a great variety of conditions, is reducing the periods of dearth, and making this region one of the most promising in the Province from a commercial standpoint. Heavy flows of nectar occur here more frequently than in any other section of the Province. Its development is slow because of bad roads and a failure to appreciate the nature of the honey flows.

**Fireweed** (see Fig. 1) may give three separate flows, the old plants, the young plants, and those growing on summer-fallow secreting at different times. The mints, especially the horse mint, produce superior honey. All species of nectar-secreting plants seem to give a lighter, milder honey than do plants of the same species in Southern Alberta, but there is a large variety of plants in Northern Alberta secreting dark honey. Their periods of flow overlap the light flows, and northern honeys tend to be dark yellow.

**Acid Soils.**—Sweet clover planted on moderately acid soils has secreted nectar for the past ten years. Wild White Dutch clover and Alsike clover are not dependable.

**Muskegs** which are covered with grass and rushes will support a growth of white sweet clover. This is one of the rare cases when it pays to plant a crop for the bees. Acid muskegs which are covered with moss are of little value.

## THE CENTRAL REGION

The central region consists of the remainder of the Province, except that section lying south of Stettler, Castor, Coronation and Compeer. In very few areas within this region can beekeeping be carried on successfully in the absence of sweet clover. The flows are not regular, nor are apiary sites with natural wind-breaks easy to obtain. Hot winds often check the honey flow and bees wear out rapidly. Frequently water should be supplied.

**The River Bottoms.**—Many attractive locations are found along creeks and rivers. Spring feed is usually plentiful, and where sweet clover is scattered along the banks or grown on sub-irrigated stretches along the streams the locations may rival the finest in the irrigated districts.

**The Foothills.**—Much of the native flora in the foothills does not yield nectar. Fireweed is less dependable than in the northern region. Wolf Willow is a heavy yielder, Snow-berry occasionally, raspberry and saskatoons, or service berry fairly certain. Usually the best sites are found on the eastern slopes. Colonies in valleys running north and south often lose four hours a day because of the shadow of high hills. Excellent crops have been obtained where sweet clover is grown.

**The Irrigated Districts.**—The majority of commercial apiaries are found in the southern irrigated districts. Here the honey flows are long and steady. The numerous fields of alfalfa and sweet clover make the establishment of large apiaries possible. Many of the choice locations have been taken, but some remain which will give excellent returns.

## THE SOUTH-EASTERN REGION

This comprises all the area south of Stettler, Castor, Coronation and Compeer. Except in irrigated districts or river valleys, conditions are usually unfavourable to beekeeping, though small apiaries of one or two colonies have been fairly successful.

**Fig. 1.—Fireweed, the most important native floral source of honey.**

## THE NATURE OF THE HONEY FLOW

The heaviest honey flows occur during hot, muggy weather. About 90% of the honey obtained is harvested by bees when the temperature ranges between 67° and 90°. Excellent flows frequently occur the day before a rain and continue for some days after it. A hot wind will often check the secretion of nectar in a few hours, if soil moisture conditions are not favourable.

Bees do not usually work any of our main sources of nectar till from 5 to 10 days after the first blooms appear, but weather conditions appear to play a greater part in determining the flow than does the age of the flower. This is particularly true in the northern part of the Province. Mr. D. A. Andrew reports that a colony in the Provincial School of Agriculture apiary at Vermilion showed a gain of 36 pounds in weight in 24 hours, and his records indicate other high gains (over 30 pounds) within two weeks of the first mentioned gain. Unless supers are in place such a flow will be lost, and the beekeeper will fight swarming instead of harvesting a crop.

From 50% to 75% of the total honey crop should be harvested between the middle of June and the end of July. August flows are important where alfalfa is grown for seed and where heavy second growth has occurred after the cutting of the sweet clover hay crop. September flows are rare and erratic. Colonies are usually not strong enough to store much honey during May or early June, and although the so-called minor sources such as dandelion, willow, fruit bloom, etc., frequently secrete heavily, comparatively little is stored. Reports indicate heavy surpluses have been obtained by beekeepers fortunate enough to have strong overwintered colonies in years with mild, warm springs.

The further north one goes, the later the flow for any given plant. At Edmonton the flow is usually 10 days later than the flow at Lethbridge. The nature of a plant determines its response to any given set of conditions. Thus, sweet clover secretes heavily in season with cool nights and warm days, while white clover gives little nectar unless the nights are warm and the days hot.

### SECTION II.

## THE COLONY

**The Colony.**—Beekeeping differs from most farm enterprises, in that it consists in the care and management of an organized body of insect harvesters, who gather nectar and convert it into honey. Successful management requires an understanding of the organization and the duties of the individuals in the colony. The colony is the unit, not the individual bee, and may be compared to a city or state which has isolated itself from all others. When congestion occurs in a colony it casts a swarm. The prime swarm consists of the old queen, approximately a third of the workers and many of the drones. The swarm leaves to establish a new colony, forgetting its old home and having no dealings with it. (See swarming.)

**Castes.**—A colony consists of thousands of workers, a few hundred drones and a queen. The worker is the smallest individual in the hive. She does all the field work and the routine work of the hive, except egg-laying. The queen normally lays all the eggs, and performs no other duty in the hive. The drone has one function —mating with the queen. As usual, nature works with a wide margin of safety, and there are a thousand drones where only one is needed.

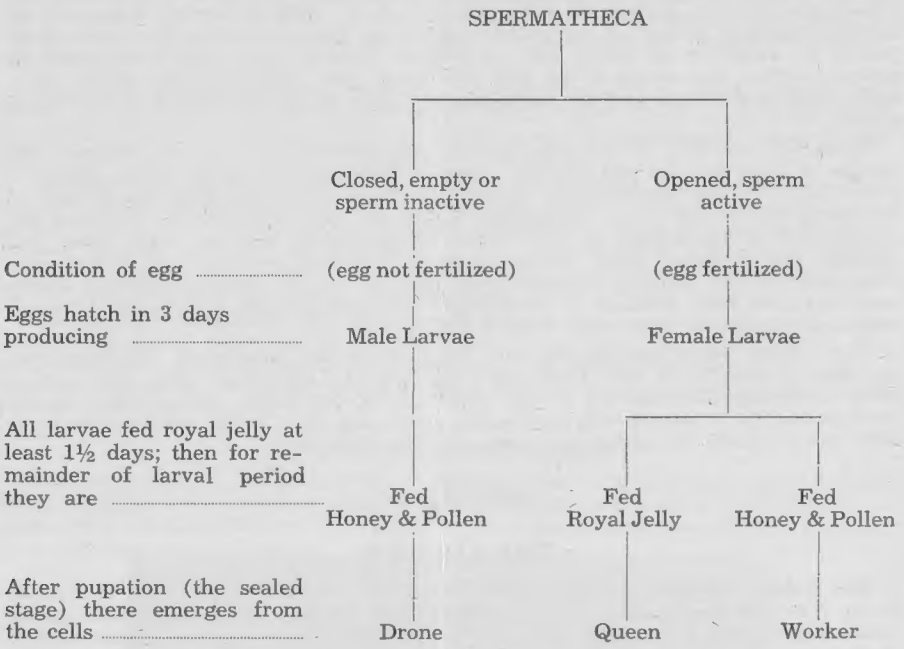
**Reproduction.**—The beekeeper will more clearly understand the reason for drone layers, laying workers, poor queens and other conditions which will shortly be discussed, if he studies the following paragraphs on "reproduction" and the chart which graphically presents the basic relationship of the organ called the "spermatheca" and food to the development of the different castes. It will be realized that a worker larva, which is fed royal jelly for more than the normal period, will have certain characters more or less queen-like, and such may be the secret of the laying workers. On the other hand, a bee which started out to develop into a worker and then because of an emergency is converted into a queen, will make a poor one.

The three kinds of individuals are all hatched from the same kind of egg. The difference between male and female is a matter of fertilization; the difference between females, i.e., queens and workers is a matter of feed. In the body of a queen is a white round organ called a spermatheca. This contains all the sperm received from the drone at the time of mating and is connected with the vagina. As the egg passes down, sperm is forced out of the spermatheca into the vagina, the egg will be fertilized, and from it will hatch a female larva. If the

spermatheca, on the other hand, remains closed, or if it contains no sperm, the egg will not be fertilized, as this word is commonly understood, but the egg will hatch, nevertheless, and a male larva which develops into a drone will emerge when the egg hatches.

All larvae are fed royal jelly or chyle for the first day and a half. After this period the drones, together with the females which are to develop into workers, receive honey and pollen. The queens are fed royal jelly throughout the entire larval period.

Larvae is the name given to bees and other insects while in the worm-like stage.


SPERMATHECA
Closed, empty or sperm inactive
Opened, sperm active
Condition of egg
(egg not fertilized)
(egg fertilized)
Eggs hatch in 3 days producing
Male Larvae
Female Larvae
All larvae fed royal jelly at least 1½ days; then for remainder of larval period they are
Fed Honey & Pollen
Fed Royal Jelly
Fed Honey & Pollen
After pupation (the sealed stage) there emerges from the cells
Drone
Queen
Worker

**Drone-layer.**—Queens which do not mate within twelve days after emerging from the cell are not likely to do so. They produce drones and are known as drone-layers. Old queens and queens which have been exposed to cold or other unfavourable conditions may become drone-layers. Such queens should be replaced at once.

**Supersedure.**—When a queen is failing the workers single out two or three female larvae less than a day and a half old. These are fed only royal jelly and their cell is enlarged. The first queen to emerge attacks the cells of her royal sisters, tears a hole in the side of the cell and stings the unfortunate occupant to death. The old queen usually disappears in a few days. She probably dies a natural death.

**Laying Workers.**—Should a queen die when there are no larvae less than two days old, the hive is hopelessly queenless. A number of workers now attempt to fill the queen's place and lay eggs. A worker cannot mate and drones only are produced. Such hives are hard to re-queen, and if not very strong, it is well to unite them with some other colony.

## DEVELOPMENTAL STAGE

Every bee passes through two distinct changes after hatching. The first is the larval stage; in this it appears as a white grub or maggot, which is fed frequently and grows rapidly till it practically fills the cell. The worker larva receives its last food about five days after hatching, and is then sealed over. It spins a cocoon from the fluid silk which comes from the glands, which open on the lower lip. The spinning takes about twenty-four hours and then the larva enters the pupal stage.

During the pupal stage interesting transformations take place. Practically the entire body is broken down and rebuilt. Twelve days after being sealed, a worker emerges from its cell. The cocoon remains attached to the cell and gives brood-combs their dark colour. The queen and drone larvae pass through similar changes. The time required is given in the following table:

**Developmental Stages**

| Stage | Queen | Worker | Drone |
|---|---|---|---|
| Egg | 3 days | 3 days | 3 days |
| Larva | 5½ days | 6 days | 6½ days |
| Pupa | 7½ days | 12 days | 14 days |
| Total | 16 days | 21 days | 23½ days |
| Adult | 2-7 years | 6 wks-8 mths | 4 wks-8 mths |

## DIVISION OF LABOUR

Normally, every worker passes through a definite series of activities which vary with age. During life the worker usually completes the full working cycle.

The following table will make clear the references to congestion. Bear in mind that a worker does not normally turn back and repeat any activity. A fielder will not feed brood in the spring, for instance. Only bees that were at that stage in the fall are efficient, and a colony lacking in young bees in the fall will dwindle in the spring, even if it pulls through the winter. The division of labour as given below is based on the researches of Dr. G. A. Rösch.

Periods of: (1) Brood Care—Bees 1 to 3 days old spend time roaming the combs and cleaning a few cells. Bees 4 to 6 days old feed old larvae. Bees 6 to 10 (possibly 13 days) feed young larvae with royal jelly which is a product of the salivary glands. (2) House Bees—Bees 10-13 days till 20 days old, act as wax builders, nectar storers, guards, and probably work with propolis. Their salivary glands degenerate; their wax glands attain a maximum on the 14th day, and degenerate by the 18th day. (3) Field Bees—From the 20th day on, bees are fielders and gather nectar, water, pollen and propolis.

Field bees are supposed habitually to stay near the entrance. If the house bees remain in the brood chamber in large numbers, swarming is likely to occur.

## RELATION OF QUEEN TO COLONY DEVELOPMENT

The queen must mate between the 7th and 12th day after emerging from her cell. This, with the slow maturity of the drones, makes attempts at natural re-queening inadvisable in the spring. The time lost by a colony attempting to rear a queen is indicated in the following table:

| | Possible Time Days | Shortest Time Days |
|---|---|---|
| Newly laid egg to emergence | 16 | |
| 1½ days old larva to emergence | ..... | 11½ |
| Emergence till mating | 12 | 7 |
| Mating till egg laying | 7 | 3 |
| Laying at fair rate | 7 | 3 |
| Total time lost | 42 | 24½ |

When the colony is to be wintered the rearing of a queen during the last week of July or the first week of August is usually profitable. The eggs laid in a hive at that time will produce workers too late to function effectively in the flow and too early for wintering. Usually conditions are favourable for the production of excellent queens, and if failure should result, the colony can be destroyed in the fall and replaced by a package in the spring.

**Chart.**—The reason for this is indicated in the Chart, which should be carefully studied. If the bookeeper will draw lines from the date on which he plans to re-queen the colony in July or August which parallel those drawn in the chart from August 11th, he can determine for himself the likely effect of queenlessness upon bees engaged in the various activities of the hive, and guage the result of his proposed manipulation on the gathering of nectar.

This chart indicates the theoretical development of the brood and young bees in a colony where the queen lays a thousand eggs a day from May 10th to August 11th, when she is caged. No allowance is made for death during any stage, except that of the fielders, who are assumed to live four weeks. After July 19th the loss in field bees exceeds the daily emergence of a thousand bees.

The probable effect of caging or killing the queen, on the numbers of bees engaged in the various activities of the hive, is indicated on the chart by the falling or rising of the lines after August 11th. It will be noted that within three days after caging the queen, the number of cell-cleaners is reduced from 3 thousand to 1 thousand, and this group of a thousand probably remain fit to do this type of work until they are killed in the fall. If such a colony were re-queened after egg-laying had ceased, these thousand cell-cleaners would continue with this work in the spring. A similar

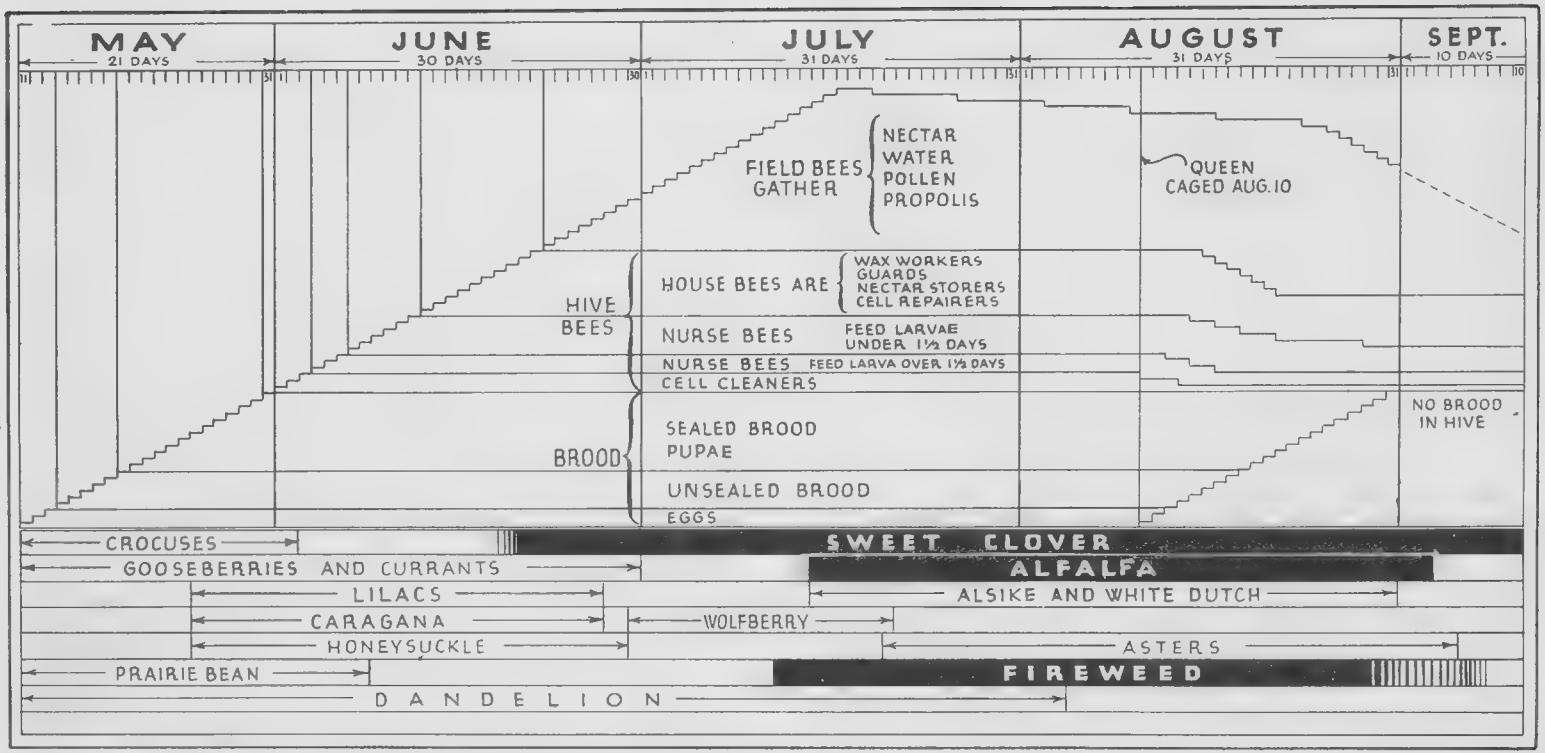



**Chart showing theoretical development of colony headed by 1,000 egg queen. Each step represents 1,000 and the zones show possible maxima of numbers in developmental stages and hive activities. Below are the approximate nectar secretion periods of the three major honey sources and several minor ones.**

reduction is noted in the nurse and house-bee groups. Here most of the cell cleaners advance to the nurse-bee stage and force the older nurse-bees into the group above them by taking over their work. This same forced promotion continues until the older groups of house-bees are driven to take on field duties at an age somewhat younger than normal. It will be noted that there is always a certain percentage in each class which remain idle and able to take up the duties of that class, should the occasion arise.

All commercial men in Alberta take advantage of their power to force young bees into the fielder class by doubling colonies having less than 7 combs of brood at the beginning of the honey flow. The same thing is done in the fall when the colonies are to be killed and late brood has no value. If, however, there is no nectar in the field the adjustment of groups, as described above, does not occur smoothly, and the lack of balance existing in the hive may find expression in attempted swarming.

The result of any manipulation affecting egg-laying can be visualized by running step-like lines from the date on which it is planned to put it into effect, parallel with those on the chart on and after August 11th.

### SECTION III.

## LOCATION OF THE APIARY

Bees are most successful in the wild state when they have chosen a high, dry cavity well protected from the wind. Usually the entrance is above heavy shade and the sun's rays filtered through the leaves to the entrance from sunrise to sunset. The force of the wind is broken at all times by the boughs, and the bees, who habitually rise high enough, after gathering a load of nectar, to clear any obstruction between the field and the hive entrance, fly well above man and beast. These factors should receive consideration in locating an apiary, and the same ends achieved even if different means are used.

**Dryness.**—The old practice of putting a hive on stilts causes difficulty in manipulation and often settling of the stake leads to the tipping of the hive. An apiary established on a well drained slope, in which the hives are raised from three to six inches from the ground by bricks, flat stones or substantial wooden frames will be free from rotting bottom boards and other minor ills. The practice of setting hives on long planks, supported at intervals, is objectionable. Any vibration along the planks brings out the guards of all the hives, and one is the object of their combined attentions till the last hive on the planks has been examined.

**Water.**—Bees require fresh water to drink, and troughs should be covered until the bees learn to go to the source provided. Apiaries established near narrow lakes or broad rivers lost many fielders when the source of nectar is on the far side. The heavily ladened fielders tire while crossing and drop into the water.

**Shade.**—Shade is rarely required by the colonies in Alberta. Heavy shade makes bees cross, and most beekeepers find it better to keep colonies at least 15 feet from trees.

**Protection.**—Wind protection is absolutely necessary. A south-eastern slope helps greatly in reducing the force of the wind, but should be supplemented by hedges or trees. Artificial windbreaks made by weaving branches through a wire fence are satisfactory. Tight wooden fences, buildings or walls, are the least satisfactory form of windbreak, for the wind tends to eddy behind them. A windbreak should be at least 7 feet high if bees are near any road or house. Unless bees are forced to rise over some obstruction they normally fly about 5½ feet from the ground. A 7-foot windbreak will keep them above one's head. Apiaries should be not less than 100 feet from roads. Bees should not be placed so close to a hedge that the sun's rays do not strike the hives early in the morning.

**Distance Between Hives.**—In fifty-colony apiaries, the colonies are usually placed in pairs with 6 to 10 feet between each pair and 16 feet between the rows. Crowding makes drifting and increases the difficulty in handling and inspecting.

## EQUIPMENT

The type of equipment is largely a matter of personal choice, but when buying hives and combs the beginner is strongly advised to buy standard equipment. Often the beekeeper has an opportunity to buy used equipment. Where he is certain the colonies and their combs are free from disease such an investment may be profitable,

**Fig. 2.—A well protected apiary at Standoff, Alberta, in early spring. The chinooks are partly checked by the high hills to the west and the fence made more effective in winter by attaching willow bows to it. Inset: Taking off honey in a commercial apiary at Coaldale, Alberta.**

but he should remember that odd sizes which prevent the exchange of combs during extracting or the exchange of brood combs from one brood chamber to another in making "increase" or "demareeing" is most exasperating. Even undoubted bargains should be considered carefully, as odd sized combs and supers may annoy you for the next 20 years.

Commercial beekeeping is based on Langstroth's discovery of the BEE SPACE. He found that bees would not close in space from 3/16 to 5/16 of an inch in width no matter how long or deep that space might be. This made possible the removable frame and easy examination of the colony. But it should be realized that any variation from this spacing gives us a non-removable frame and prevents the examination of the brood nest and the manipulations we consider necessary.

Formerly, the making of bee equipment was practically confined to large firms, and the hive bodies and frames were made of well seasoned wood. The dimensions of the various parts rarely varied from the standard dimensions. Today, however, a large number of small power wood-working outfits are scattered through the Province, and bee equipment is being made by many unfamiliar with the dimensions of the hive and frames and utterly unaware of the need for seasoned wood. Every beekeeper should know the dimensions of his own equipment, and for the beginner, who may have opportunity to buy equipment, the following **inside** dimensions of the hive are given:

**Inside Dimensions of Langstroth Hive Body**

| | |
|---|---|
| Length | 18½ inches |
| Width | 15⅛ inches |
| Depth | 9½ inches |
| Width of rabbet | ¼ inch |
| Depth of rabbet | ¾ inch |

The length of the top bar is 19 inches and the depth of the frame (outside measurement) is 9⅛ inches.

**The Hive.**—The modern hive consists of a number of uniform boxes and has a removable top and bottom. Each box usually contains ten removable hanging FRAMES, and since they (the boxes) have neither top nor bottom must be strongly made—preferably dove-tailed. The box in which the queen lays her eggs is called the BROOD CHAMBER or HIVE BODY, and the combs in which the eggs are laid are called BROOD COMBS. The boxes in which honey is stored are called SUPERS and the combs they contain SUPER COMBS. The COMBS are built inside the FRAMES by the bees from a base in the form of a full sheet of FOUNDATION. This FOUNDATION is a sheet of wax on which are embossed a series of indentations, each the exact size of the base of a worker cell. If the bees are not given full sheets of foundation they have a tendency to produce a large number of drone cells, and the resulting comb is worthless for the brood nest. It can be used in the super for honey, but much drone comb is unsatisfactory, even here, because of the constant danger of queens getting to the drone comb. The finest worker combs are used in the brood nest. Those containing a large percentage of drone cells are used in the supers.

**Foundation.**—The beginner should buy wired, medium brood foundation. This does away with embedding. The frame is made ready for the hive by simply slipping the sheet of foundation through the groove in the split bottom bar and fastening it securely to the lower side of the top bar by wedging the loose piece of top bar against the foundation and nailing it.

When unwired foundation is used the frame must be strung with wire (No. 28). This wire is embedded in the sheet of foundation by means of a spur embedder on an electric embedding device. A common method of wiring the frame is illustrated in Fig. 3. The wire is threaded through the holes in the end bars and the free end of the wire wound around a tack which has been driven part way into the narrow side of the lower end of the end bar of the frame. This tack is then driven home, and the wire worked back and tightened till it "sings" when thumbed. A second tack placed on the same side of the end bar, but toward the upper end, is used in similar fashion to hold the other end of the wire after it has been tightened. The unused wire is twisted off close to the tack so no small projecting end is left to tear the fingers when the frame is handled. The two tacks are placed so they will not be driven into the upper and lower holes through which the wire is threaded.

The frame is kept true by nailing pieces of lath on a board and so making a form which holds the frame while the wire is being strung and tightened.

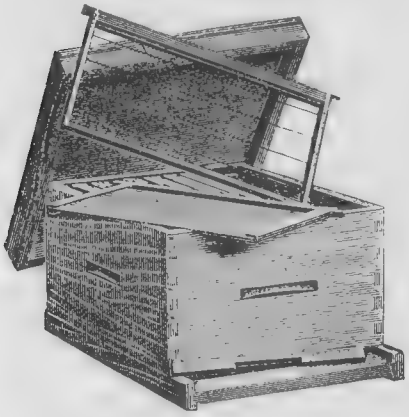


**Fig. 3—Hive Showing Frames and Division Board**

**The Hive.**—Every colony should have two brood chambers and three full depth supers, each with its complement of 9 or 10 combs or frames with full sheets of foundation. This will provide storage for approximately 140 pounds of honey and meet the requirements of the average queen. Any attempt to do with fewer supers in a good district will usually result in the loss of part of the possible crop, greatly increase the time required for manipulation due to increased extracting and swarm control measures. Where only one or two colonies are kept and there is no intention of increasing the number, four or five "shallow supers" may be used in preference to the deep supers, and the comb cut out and served or sold as "cut comb" (see "cut combs").

The production of "sections" is not recommended for beginners. Those interested should write for Demuth's Bulletin (see Appendix).

Each hive should be supplied with a telescope cover (Fig. 3), as this type does not readily blow off the hive or warp. The division board formerly much used to nurse along weak colonies by reducing the size of the brood chamber, now finds a place in queen rearing if so made that it forms a bee tight wall, when used to separate two nuclei in the same hive.

It is usually well to have an additional hive body, 9 or 10 combs, a cover and floor to care for a swarm. Queen excluders are used to confine the queen to the brood chamber, and are very useful in swarm control methods used with the Langstroth Hive.

Every beekeeper needs his own veil, smoker and a hive tool or a stout screw driver. Any attempt to work without a smoker and a veil will usually result in severe stinging sooner or later, and the colonies will then be neglected. Smokers with barrels less than 3½ inches in diameter are of little value when smoke is really needed.

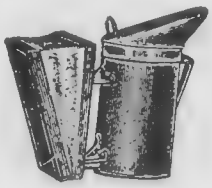


**Fig. 4.—A Smoker.**

The practice of borrowing extractors or other bee equipment is dangerous, as even careful washing may not always be thorough enough to remove every particle of honey and wax.

When possible, two or four framed reversible extractors should be purchased. A four framed reversible should handle the extracting for 150 colonies without any difficulty, and if power is used, many more.

Usually a steam-heated knife or a "plane" is regarded as essential, though butcher knives are used in very small apiaries. Honey tanks holding from 500 pounds to two tons are in common use. The beekeeper is referred to the illustrated catalogues of bee supply houses for other equipment.

## SECTION IV.

## CARE OF PACKAGE BEES

Package Bees are sold by the pound and shipped in screened containers from the Southern States to beekeepers who wish to establish new apiaries or to re-stock old ones. The two-pound package is the most commonly used by beginners, but the three-pound package is preferred by the majority of commercial men.

Queens are usually shipped in a small separate container known as a queen cage, which is suspended from a wire or metal strap and hangs inside the package cage against, but not attached to, the feed tin, or rests in a pair of metal brackets near the opening through which the feed tin is passed. Queen's cages may vary widely in form, from the screen-faced hollowed wooden block to metal tubes with holes along the sides.

**Care of Package Bees on Arrival.**—It is well to inform the station agent that you are expecting a package of bees and have him telephone you as soon as they arrive. Also, request that they be kept out of the sun and wind. If you have far to drive, and the day is warm, brush warm water over the screened sides of the package cage with a wisp of grass or a brush. Let them have plenty of air, but do not subject them to a strong wind or sun.

Should a package arrive with many dead (a quarter or more) sign for them in the condition in which they are found and also have the express agent make a similar notation on the express receipt, then accept the package of bees. Notify the shipper of the bees immediately and he will usually make an adjustment. Without a proper notation on the express receipt, it is impossible for him to obtain an adjustment from the express company.

## REGULATIONS

**Charges.**—Bees are exempt from sales tax at the time of writing, but there is a three per cent. Dominion excise tax on all shipmnts valued at $25.00 or over. These shipments must be cleared at customs either by the ownr, by a custom's broker, or by someone with a Power of Attorney. Where the shipment is valued at $100.00 or over and the consignee is in an outlying area where train connections are particularly important, he should arrange to place Power of Attorney with the express company prior to the arrival of the shipment. In this way no time will be lost if there is little time between incoming and outgoing trains.

**Clearing at Customs.**—The consignee can simply bring his invoices to customs where shipments are valued at less than $100.00, and the entry is handled readily. When shipments are valued at over $100.00 they must have a "Long-Room Entry." When the consignee cannot clear the bees, this is usually done by a custom broker.

**Costs of Clearing at Customs.**—The generally accepted custom broker's fees relating to bees (1937) are as follows:

| | |
|---|---|
| Shipment value not over $50.00 | $ .50 |
| Shipment value not over $100.00 | .75 |
| Shipment value over $100.00 | 1.00 |

A customs officer may charge overtime if required to release shipments after hours.

**Pure Food Certificates.**—Pure food certificates must accompany each shipment, and if queens are shipped back to California they must be accompanied by a statement indicating the "food supplied to the bees and carried in the packages (or queen cage) is free from disease." Usually, the feed supplied to bees is either sugar-fondant or sugar-syrup. Honey must not be used, even if it is known to be free from disease. No bees on comb or used equipment can be shipped into the United States or adjoining Provinces or brought from these areas into Alberta.

## INSTALLING THE PACKAGE

Unless the weather is unfavourable to flight, packages should be placed in a cellar or some other dark cool place till sunset, and then installed in the hive. Any attempt to install the packages during the day will usually result in drifting, and the colonies will vary widely in colony strength. If the weather is very cold and the packages are chilled, revive with a feed of warm syrup brushed over the screen sides of the cage.

**Preparing the Hive.**—The hive is placed on its permanent stand. In it are ten frames with wired foundation, or nine frames of drawn comb, leaving equal spacing between every comb if they are not self-spacing.

**Feed.**—A jam tin or honey pail filled with sugar syrup, 1/3 sugar to 2/3 water, having a lid with 15 to 20 holes made by a lath nail is inverted on the top bars of the frames on one side. It is well to have it rest on two short pieces of lath as this enables the bees to take the syrup down more rapidly.

On the opposite side, two laths are placed for the package cage to rest upon. These pieces are high enough to allow the bees to walk about under the inverted cage and prevents them from being crushed.

**The Veil.**—The beginner should always wear a veil, and if he is nervous, leather or bee gloves. His smoker should be handy, and a hive tool or stout screwdriver are essential.

**The Smoker.**—A 3 or 4-inch band of dry gunny sack with ravelled edge fairly loosely rolled is probably the most common fuel used by Alberta beekeepers. Punk or dry rotten wood, bark, chips and cotton waste are also good. The beekeeper may

light the roll with a match, or place a live coal or two in the smoker, and then put in his fuel. After the smoker is "going well," and every compression of the bellows sends out a cloud of white smoke, put a handful of green leaves or green grass into the smoker on top of the fuel. This will give you a "cool smoke" and prevents any bits of carbon from being blown out over the combs. Do not "stuff" the smoker.

**Removal of Feeder Can.**—Having removed the cover of the hive and placed the package cage across a corner of the empty super, which rests on the top of the hive, remove the slot holding the feeder can in the cage and slowly work it up, constantly turning or twisting it to prevent bees being caught between the wood and the tin.

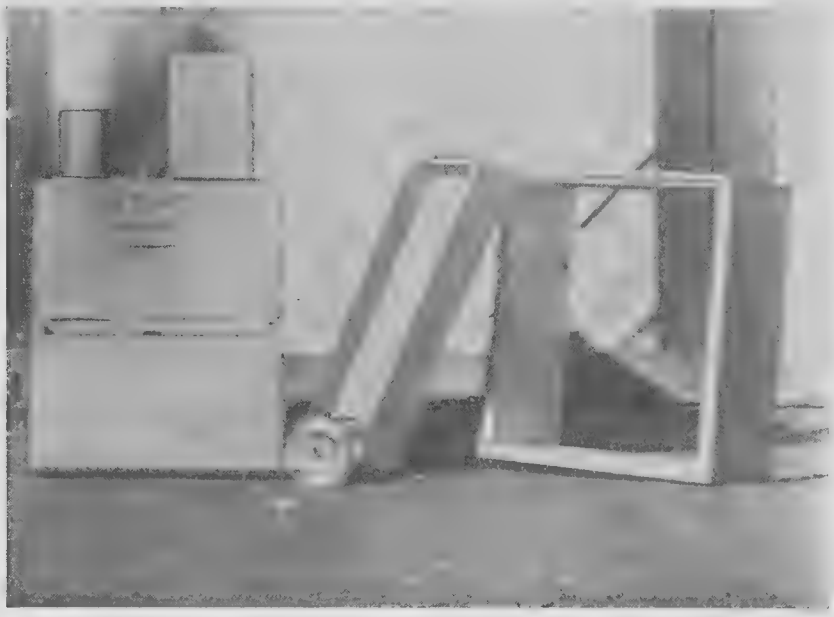


**Fig. 5.—Installing package, 1st method. Note high stand, alighting board and reduced entrance.**

**Fig. 6.—Hive prepared for installation of package, 1st method.**

Just before the can is high enough to slip out drift a puff or two of smoke around the feeder can to check any tendency toward flight, or jar the package smartly on the corner of the empty super so the bees clustered about the can inside the cage will drop. (Jarring is avoided when possible, as there may be some injury to the queen.) Now twist the can out, shake the bees off, and throw it away. Pull out the queen cage and invert package on laths prepared for it.

The most commonly used queen cage is a hollowed block of wood with a small hole at each end. The top is covered with a screen, below which will be seen the queen and her workers, and the feed. See that the queen is alive. Next remove the piece of heavy paper, cork or other means used to prevent the bees eating their way into the cage during transit, and tunnel through the candy with a match or small knife blade. Do not make the hole so large the bees can get in at once.

At the other end of the queen cage is a small hole closed with a round perforated metal cap. Should the weather be cold, or if for some other reason the rapid release of the queen is desired, push this in with a wooden-plug, being careful not to injure the queen, and fill the hole with soft granulated honey or very soft sugar-fondant. Now place the queen cage* screened side down on the top bars of the frames so it is in direct line between the opening in the inverted package cage and lift it, shaking as many bees as possible, down over the queen cage. If you shake them all out, so much the better, but this is not necessary. It is usually best to put the package cage back on the laths prepared for it as soon as the bees show signs of flying. Cover the package cage, the queen cage and feed tin with clean burlap or other material to prevent the loss of heat, fold in the tarpaper, replace the cover and then cut a small hole about ½ in. in diameter in the tarpaper in line with the entrance of the hive, so that the bees can get out.

### A Commercial Method, as Outlined by R. H. Hawthorne, Manager of Reidell's Honey, Limited

"We have our packages coming in at the rate of about 100 per day and set them out in the yards with 50 or 60 in each yard. The yards are from a mile and a half to two and a half miles apart. As the bees come in on the night train we usually carry them over a day to place in the yards. The truck leaves the plant with everything including packages for placing a yard of 60 about four o'clock in the afternoon. Each brood chamber is made up with the combs before being placed on the truck. We use five combs, placing them in rotation from the side of the super as follows: Heavy pollen (may be a little honey in it), heavy honey (four pounds or better), light honey with small brood nest open (up to two pounds of honey), empty brood comb, medium honey with small brood nest open (two to four pounds of honey). As soon as the truck arrives at the yard one of the men starts separating the packages while others place the hives, allowing the regular spacing between the combs. Each package is placed in the shade of the hive it is going to be placed in and left alone so the bees will cool off and settle down after the truck ride before trying to take out of the package. After the sun goes down and timing it so the job will be finished before dark, we start releasing. We place the package in the space left in the hive and take the feed can out with as little disturbance as possible and lay it on top of the frames with a small cluster of bees hanging on. We then take the queen cage out and punch out the hole opposite the feed end and refill it with soft crystallized honey and place the cage on top of the frames so that when the queen comes out she will go down between the third and fourth combs. A short piece of wood is placed from the top of the package to the top of the frame next and extending over to the end of the queen cage where the queen will come out. This should be placed so the bees will follow it as they come out of the package. We then shake the bees off the bottom of the feed can over the queen cage. Place a burlap cover over the hive and put the top on. The small stick will hold the burlap cover up so the bees can get to the queen cage.

"The second morning after, we return to the hive and take the top off, turn the burlap cover back only to the comb next to the empty package. Reach under the burlap and take out the queen cage, seeing that the queen is out, and then take the package out and shake any bees still in the package out in the hive. We then feed ten pounds of heavy sugar syrup in two five-pound pails placed in the place of the package. These can either be placed upside down on a ten-pound pail lid with a small nail under one side of the pail, or right side up with a little straw placed in the syrup for the bees to walk on to get at the syrup without getting drowned, and in the latter case place it close to the comb so that the bees can walk off the outside

*The queen cage may be suspended (candy end to the top) between the central comb if the weather is cold, care being taken to leave sufficient space between the screened side of the cage and the face of the nearest comb to allow bees to work over the screen.

comb on to the straw. Cover the hive up and leave it. Depending on the weather being warm or cool, we go back in four or eight days and take out the empty cans and place another four combs in the hive. Next to the comb in the hive we place two empty, then a light and on the outside another medium honey with a little pollen in if we have it. In a very few days we find the bees have transferred both honey and syrup into all the combs, leaving a brood nest for the queen all through the centre of the hive.

"After about two weeks from the time the hive is placed we make an inspection to see that the queen is laying as she should be, and at this time we find it a good policy to have extra queens on hand to replace if we find a drone layer or not solid brood. Do not be too quick to condemn the queen for laying two or more eggs in the same cell after she has been released, as this often happens after she is closed up in the shipping cage. We mark the hives and look later for trouble. For feeding we also use the ten-pound pail in the second super, but in April we prefer to keep down to one super high in case cold weather should set in. The bees are in better shape to keep warm. We have a good dandelion honey flow about the tenth of May, and find with this the bees have enough feed to carry them until we put on the second super of combs. Without this we would place at least another heavy honey in the brood chamber. We place the second super of combs on the brood chamber when we see at least six or more heavy frames of brood and the brood chamber full of bees. Better a little late than too early. We take a good hatching frame of brood from the brood chamber and place it in the centre of the second super and place an empty comb in its place in the brood chamber, but on the outside of the brood so as not to split the brood combs. We also place the balance of our feed honey on hand in the second super and on the outside so the centre of the super will be open for the queen. In carrying over packages of bees for a day or two we always feed them warm sugar syrup sprinkled on the wire screen of the package."

## SECTION V.

## THE INSPECTION OF COLONIES

Before discussing the first and second inspections of package bees it is well to consider the general reasons for inspection, and in the following discussion many matters self-evident to the experienced apiarist, but often a source of trouble to the beginner, are considered.

There is no virtue in the opening of a hive and the lifting out of the combs, except to give the beginner confidence. Before approaching the hive the beekeeper

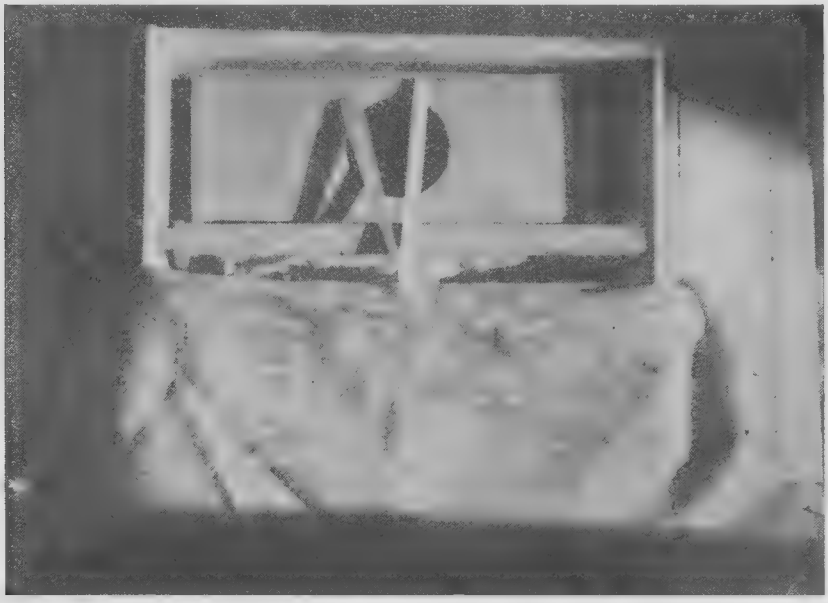


**Fig. 7.—2nd Method of installation. The queen cage hangs between combs.** **See footnote, page 15.**

should consider the purpose of the examination, the extent to which the colony must be disturbed, and the remedial measures he will use if certain undesirable conditions are present.

**Hives are examined periodically to determine:**

(1) Strength of the colony.
(2) Quantity of stores (honey and pollen).
(3) Condition of the queen.
(4) Size of the broodnest.
(5) Preparations for swarming.
(6) Disease.
(7) Need of supers for the storing of honey.
(8) Honey ready for removal.
(9) Presence of mice, ants and other pests.

(1) **Strength of Colony.**—A pound of bees numbers between 4,300 and 5,000 bees. When a beekeeper opens a hive in the spring he guesses at the numbers of bees by counting the number of combs covered with bees. Any colony which does not cover both sides of two combs and partially cover the faces of the two adjacent combs at least, is regarded as too weak to carry through the spring, if wintered, because the winter will have taken a heavy toll of the strength of the remaining bees. On the other hand, a two-pound package will seldom cover this space in cool wather, but being composed of young bees only, will have the vitality necessary to meet the demands of colony life. A three-pound package will cover from 4 to 6 combs ten days after installation, depending upon the temperature.

In the fall a colony should cover at least six frames. Again the age of the bees is a prime factor. Old bees are a liability, not an asset, to a colony going into winter.

(2) **Quantity of Stores.**—(Feed). It is considered that a colony will use at least 30 pounds of honey or its equivalent in sugar syrup from the last week in April till the main flow comes towards the end of June. In certain sections, particularly in the Northern section, spring flows will enable bees to gather a large part of this, but a beginner should plan to give his packages, especially those on foundation, as much sugar syrup (2 parts sugar to 1 part water) as they will take down. It is far more profitable to feed syrup and have comb drawn out than to let a colony just hang on till the flow begins and then build up on it. A wintered colony or a package placed on combs should have at least two full combs of honey and three combs about a third full. A package given honey-filled combs should also receive a ten-pound pail of sugar syrup. This will reduce to some degree the heavy loss of bees who search for water. The capping should be removed from honey filled combs in the spring to encourage the bees to use the honey.

**Granulated Honey.**—Honey which has granulated in the comb may be so hard that the bees cannot use it to advantage. Such combs should be placed in a tub of warm water (wax melts at 143 degrees, and water boils at 212 degrees) overnight and then uncapped and given to the bees. The water in the tub will, of course, contain some honey which may be fed to the bees.

**Quality of Stores.**—In the spring rather poor stores, such as honey dew and late fall honeys may be safely used.

**The Queen.**—The condition of the queen is determined by the manner in which she lays her eggs. Concentric ovals of brood of various ages with few missed cells, indicate an enlarging brood nest and a good queen. Poor combs with much drone and storage cells mask the quality of any queen, and the beekeeper expecting a queen to work under such conditions should be slow in condemning her.

A Drone Layer's eggs hatch and produce only drones. The high domed rather bullet-like capping of drone brood is a sign for the immediate replacement of the queen, if she was given good worker comb or foundation.

A Failing Queen is one who through age, accident or disease is unable to keep up a normal egg laying rate. She tends to be a patchy layer, missing many cells, often goes out of her way to lay in drone cells. Often many larvae fail to complete their development. The percentage of drones produced rises rapidly, and frequently she lays many eggs in a cell. The laying of a number of eggs in one cell may be due to a lack of cells ready for egg laying, and is frequently met with during the first week after the introduction of a package or mail order queen.

**Size of the Brood Nest.**—The brood nest is composed of the cells in which the queen is laying eggs and the cells containing developing larvae and pupae in all stages. The arrangement of the brood nest should not be changed without good reason, such as the removal of a frame of drone comb, or as a means of swarm control (Demaree

system). In the spring it is highly inadvisable to spread the brood nest and place an empty brood comb in the centre. Normally, the queen will not lay more eggs than the bees can incubate, but the presence of an empty comb in the very centre where temperature conditions are satisfactory, will lead to immediate filling. The size of the brood nest is determined by the following:

(a) **The number of bees in the colony.** A brood nest that shrinks in the spring may indicate a high death rate of old bees, or a failing queen. A queen that fails to rapidly enlarge her brood nest in the spring is of doubtful value if conditions are favorable to brood rearing.

(b) **The amount of honey and pollen.** Nurse bees prevent the expansion of the brood nest by removing and often eating the eggs when honey or pollen is lacking. The older larvae are starved and then thrown out, and later the nurse bees fail to secrete enough chyle or royal jelly to feed the youngest larvae. Even where there is enough honey in the hive for present needs there may be a strict curtailment in the amount of brood. A short spring flow may fool the bees and cause a sudden enlargement in the brood nest with the consumption of all stores.

(c) **Water.** Bees need water to digest pollen and honey.

(d) **The temperature.** Cold will prevent the expansion of the brood nest, even if all other conditions are satisfactory.

(e) **A Second Brood Chamber** is not added till the bees cover at least 8 combs and have brood in 5 to 7 combs.

**Preparations for Swarming.**—The common sign is the building of queen cells, and loafing. (See swarming on page 23.)

**Disease.**—(See Chart on page 32.)

**Need of Supers and Removal of Honey.**—Supers are added as soon as the last one is half to two-thirds full, during a heavy honey flow, and removed when the combs are from half to two-thirds capped.

### OPENING THE HIVE

Try to examine the hive between 10:30 a.m. and 3:00 p.m., on days when the sun is shining, and there is little or no wind. Approach the hive from the side or rear and take up a position so the sunlight comes over the shoulder. It is difficult to see eggs or symptoms of disease if facing the light. Send two or three puffs of smoke into the entrance to disorganize the guards and then gently lift the cover. Send in a little smoke and as soon as a subdued hum is heard, remove the cover, jar off any bees on it in front of the hive and put to one side or set it on edge and use it for a seat. If necessary, drift a little smoke over the frames and loosen then with a hive tool. Remove one of the outside frames or one of the pair next to them, if the outside pair are attached to the wall with burr and brace comb, and place the removed comb so that its side or top rests against the front, far corner of the hive. Lift out each frame in turn and examine.

The queen will usually be found in the centre of the cluster on a comb containing eggs, unless too much smoke has been used. She prefers a dark comb, and experienced bee men, when clipping queens in the spring, often find her on the first or second comb they choose to examine.

### It is Not Necessary to See the Queen Every Time the Hive is Opened

All movements over the hive should be slow.

Avoid crushing bees.

If one tends to perspire, turn the smoke on the hands and wrists. Do not wear woolly, fuzzy, hats, caps or clothing. A slightly starched, well ironed, white shirt is excellent in warm weather. Bees ignore white cloth more than coloured, and a painter's smock and overalls are good, but zipper overalls are better.

Leggings or high boots, socks over the trousers, or strings around the pant legs will prevent much discomfort.

Put covers on tightly to prevent robbing.

Make a practice of putting all bits of comb in a can and taking it away. The wax is worth money, and at certain seasons a bit of comb honey left outside a hive will cause robbing.

## THE FIRST INSPECTION OF PACKAGE BEES

Since the conditions in a newly installed package differ somewhat from the established colony, the main purposes and precautions are outlined below. For all subsequent examinations the package may be considered a colony.

**The First Inspection.**

It is commonly agreed that the longer a package remains undisturbed after introduction the better for the queen. No examination should be attempted by the beginner unless the sun is shining brightly, very little wind and the temperature around 70 degrees Fahr. The first manipulations may be made on the fifth day after installation if the weather conditions are very favourable, but the colony should be left strictly alone till then.

**Purpose:**

To see if queen is released.
To remove the package and queen cages.
To refill feed can.
To put canvas, oilcloth or clean burlap over the frames and so check the loss of heat from the colony.

**No Frames should be lifted out,** nor is any disturbance of the combs advisable. Smoke should not be used. If you cannot do the things outlined without disturbing the bees, close the hive and leave them alone.

**The Second Inspection.**

The second inspection is usually made on the 10th or 12th day after the introduction of the package. If the methods of introduction have been carefully carried out, the first inspection can be omitted.

**Purpose.**—The primary purpose is to make certain the queen is not a drone layer.

**Method.**—Remove cover and lift out the empty super, leaving the tar paper in place. Remove feed pail, package and queen cages if in the hives, and then one of the outside combs. Push combs over to the vacant space till a comb is reached containing sealed brood. If there is brood in all stages and most cells sealed have the low rounded worker capping and few cells have been capped with high rounded cappings that stand up like bullets or domes, the queen can be regarded as all right. If so, the examination is over. Push the frames back into place, replace the one removed, put on the sack, or piece of canvas with an "L" shaped cut. Refill and replace feeder pail over the opening in the canvas made by tucking in the flap of the "L" shaped cut. Put in the empty super, being careful not to tear the tar paper, and put on the cover. Little or no smoke should be required. For other conditions, see Trouble Chart.

### RECORDS

Commercial beekeepers rarely keep records of their hives. A brief note on the inner wall of the packing case or cover, if an unsatisfactory condition cannot be remedied at once, or a stone or bit of wood at one corner of the cover to jog the memory when the next visit is made is the usual method. When one's hands are sticky with propolis and there is much to do before the day is over, note-making is rather difficult. However, a beginner lacking a knowledge of the honey sources of his district, the time of the honey flow, the rate at which bees build up, etc., will be well advised to keep a record of each examination.

**A Suggstion for a Beginner's Apiary Notes:**

| Hive No. 1— Date of Examination | Frames Bees | Frames Honey | Frames Pollen | Frames Brood & Eggs | Queen | Other Observations |
|---|---|---|---|---|---|---|
| | 5 | 6 | 1 | 2 | O.K. | |

The strength of a colony is gauged by the number of frames (or combs) the bees cover. In the above examples they are found on five frames. There is the equivalent of six full frames of honey, though it may be in nine partly filled frames. Pollen is found filling the majority of cells on one comb and eggs and brood are found on two frames. The eggs indicate that the queen has been in the hive within four days, and a further search for her is not necessary. The amount of brood, a term which includes bees in both the larval and pupal stages, and eggs together indicate the vigour of the queen. O.K.—queen has been seen and is apparently in good condition. In the column headed "Other observations," such items as the colour and flavour of new honey, its probable source, need for supers, new pollen and its probable source, giving or removal of supers, indications of swarming, supersedure, queen cells, etc., are noted.

The following record published through the courtesy of Mr. R. N. Wilson of Standoff, Alberta, will give to the beginner some idea of time and the necessary manipulations as well as the amount of equipment required by a good colony.

## RECORD OF COLONY 13, 1930

| | | Combs Containing | | | |
|---|---|---|---|---|---|
| | | Brood | Stores | Empties | |
| April | 22 | 5 | OK | 0 | This package No. 10 last year, 2nd best producer, 1929. |
| May | 3 | | | | 1 frame brood and eggs given to package No. 12. |
| | 13 | | | | Unpacked. |
| | 22 | 6 | 1 | 3 | |
| | 25 | | | | Double brood chamber (on top); 5 dark and 5 light. |
| June | 4 | 7 | | | Saw clipped queen. |
| | 10 | 7 | | | Below all empty. |
| | 16 | 8 | 1 | 1 | |
| | | 1 | 1 | 8 | Just started to lay below. |
| | 23 | 8 | 1 | 1 | |
| | | 2 | 0 | 8 | Laying well below. |
| July | 1 | 8 | 2 | 0 | Many queen cells. |
| | | 4 | 3 | 3 | Cut 4 queen cells, reversed brood chambers. |
| | 4 | | | | Gave 2 combs of brood and eggs to 19. |
| | | | | | If many cells next time make artificial swarm. |
| | 8 | 0 | 8 | 1 | Totals 10B and 10H so gave super to |
| | | 5 | 0 | 5 | With 6 foundation, and 3 drawn combs bringing honey to top. |
| | | 5 | 2 | 3 | Combs arranged as indicated in column. |
| | | | | | Capping and filling. |
| | 14 | 0 | 9 | 0 | |
| | | 6 | 3 | 1 | |
| | | 5 | 5 | 0 | |
| | | | | | Gave 4th story of foundation, rearranging as shown. |
| | | 0 | 9 | 0 | |
| | | 0 | 7 | 3 | |
| | | 5 | 0 | 4 | |
| | | 6 | 1 | 3 | Queen below with 6 sealed brood; 1 pollen and 3 empty combs. Should be O.K. till super is ready. |
| | 24 | 0 | 9 | 0 | ¾ Capped, ready. |
| | | 0 | 9 | 0 | Nearly full of honey. |
| | | 5 | 4 | 0 | 5 emerging brood; 4 full of honey. |
| | | 8 | 2 | 0 | 2 pollen; gave a 5th story, and raised 2 brood combs for empties. One of the strongest stocks and best. |
| | 27 | | | | 47 lbs. |
| | 31 | 0 | 9 | 0 | ¼ Capped. |
| | | 5 | 4 | 0 | Some merging brood and 4 full of honey. |
| | | 0 | 9 | 0 | Drawing foundation and filling. O.K. |
| | | 7 | 3 | 0 | Raised 2 for empties. Sort 2 and 3 after top super is off. |
| Aug. | 7 | 0 | 9 | 0 | Ready. |
| | | 0 | 9 | 0 | ¼to ½ Capped. |
| | | 0 | 0 | 0 | Full. Needs super. |
| | | 9 | 1 | 0 | Crowded—must be relieved. |
| | 8 | | | | Supered, gave 2 frames of brood to No. 15 for empty combs. |
| | 8 | | | | 51 lbs. |
| | 12 | | | | 50 lbs. |
| | 13 | | | | Added 4th story. |
| | 15 | 0 | 9 | 0 | Ready. |
| | | 0 | 9 | 0 | Full and capping. |
| | | 0 | 9 | 0 | Filling rapidly. |
| | | 7 | 3 | 0 | 3 cells cut. |
| | 18 | | | | 46 lbs. |
| | 25 | 0 | 9 | 0 | Top ready. |
| | | 0 | 9 | 0 | Nearly ready. |
| | | 0 | 9 | 0 | Nearly full. |
| | | 8 | 2 | 0 | 2 combs of brood to No. 23 for dark combs. |
| | | | | | Added 5th story and escape. |
| | 28 | | | | 53 lbs. |
| | 30 | | | | 43 lbs. |
| Sept. | 3 | | | | Top-half of combs well filled. |
| | | | | | Middle nearly empty. |
| | | | | | Top ready. |
| | | 7 | 2 | 0 | |
| | 17 | | | | Middle filling a little. |
| | | 6 | 4 | 0 | 1 sealed brood to No. 12 to help. |
| | 20 | | | | 17 lbs. |
| | | | | | Total production 307 lbs. |

SECTION VI.

## APIARY MANAGEMENT

The successful management of an Apiary requires personal qualities and a wide range of beekeeping knowledge, which can only be touched upon in a bulletin. Usually the successful beekeeper is a careful, methodical man, with a deep and keen appreciation of nature and be an organizer. He must have a good grasp of factors relating to colony development and a complete knowledge of the habits of the bee. He can recognize normal and abnormal conditions in a hive at a glance and knows the methods of correcting abnormal conditions. Finally, he must be able to hasten or retard the development of a colony so that it reaches its peak population shortly after the main honey flow begins. Such knowledge enables him to co-ordinate the development of his colonies with the times and nature of the honey flow.

**Factors Which Determine a Honey Crop.**—Demuth has pointed out the five main factors which determine the honey crop:

1. "A surplus population."
2. "A predominance of the storing instinct."
3. "Control of swarming."
4. "Honey plants growing under optimum conditions."
5. "Weather suitable for nectar secretion and nectar gathering by the bees."

"If any one of the above factors is reduced to zero the crop is zero. If any is reduced to half, the crop is half the maximum." It is evident that the beekeeper has no control over the last two, but since he can control to a large degree the first three he must needs give them serious considration.

**Surplus Population.**

A surplus population, i.e., bees over and above those necessary for colony maintenance, can be largely determined by apiary management. By June 15, roughly half the bees in the hive are field bees. According to Parks, a bee makes 10 trips a day and carries one-quarter of her weight in nectar. Hambelton estimates one-quarter of this nectar is evaporated, and goes on to say that if there are 5,000 bees to the pound, a colony with a field force of 21,000 bees could make a daily gain of 7⅞ pounds, and a colony with a field force of 28,0000 bees a gain of 10 pounds a day. Our long summer days raises the number of trips per bee and the possible total per day, but the importance of numbers remains. A beekeeper who has replaced poor queens, provided an abundance of stores and given room as required should have no weak colonies when the honey flow comes, but if a beekeeper has weak colonies a ruthless uniting of colonies or "doubling" is the only way to get a maximum crop.

**Predominance of Storing Instinct.**

Bees are creatures of instinct and respond in only one way to any given stumulus, but frequently they are subject to a number of stimuli which mask the effect of the stimulus known to the beekeeper. He may, therefore, create conditions which should cause a certain response and be disappointed by an unexpected reaction; for instance, a colony may be given plenty of room, but if the weather is unfavourable to bee flight for much of the day swarming preparations will be observed. Again, a beekeeper may prevent actual swarming by cutting queen cells, but the bees will continue to loaf in the hive, gathering comparatively little nectar, and if the swarming instinct is strong enough, may actually swarm out, leaving no queen cells.

## SWARMING

The thought behind every manipulation from the first examination till the honey flow, may be summed up in one sentence: "Keep the colony strong."

However, a sense of strength or congestion in any colony which is not wholly absorbed in the gathering of nectar leads to a train of activities which normally ends in swarming. Swarms are objectionable from the beekeeper's standpoint as they result in the division of the colony's forces and a reduction in the crop. During the preparation for swarming there is a reduction in the gathering of nectar. In the greater part of the Province the swarming season is just before the main flow, but swarming should not be linked with dates, but with weather and conditions in the hive. The conditions causing swarming may be a lack of storage space, a honey-bound brood nest which prevents the queen from laying, or a congested condition in the brood nest due to field bees being kept in by unfavourable weather or lack of nectar. There may be a need of ventilation, and many other factors at times play a part, but the sense of congestion is always present when swarming preparations are begun.

When the swarming tendency is discovered soon enough and the condition leading to swarm preparations corrected, no further steps may be necessary, especially if a flow comes on. Preventive measures are more effective in ensuring large crops than remedial measures.

The preventive measures are such as make the environment unsuitable for the development of the swarming impulse. The most common are:

(1) The introduction of young queens preferably from a colony that has not swarmed.

(2) The prevention of crowding in the brood chamber previous to the honey flow. This is often done by giving a second brood chamber.

(3) The use of good worker comb in the brood chamber.

(4) Ventilation, by leaving large entrances, or introducing fine wedges between the floor of the hive and the brood chamber, or staggering the supers.

(5) Always leaving an empty super on when removing honey as long as there is a flow. Often much honey is lost and congestion and swarm preparations follow the placing of a bee escape directly above the brood chamber.

(6) The placing of supers as needed.

In extracted honey production the above will usually control swarming, but during a season in which the field bees are confined to the brood nest during a considerable part of the day as a result of unseasonable weather, the sense of congestion cannot be overcome by the above methods and remedial methods are necessary.

**Remedial methods are all based on the following:**

(1) Removal of the queen.
(2) Removal of the brood.
(3) Separation of the queen and brood (Demaree).

The idea behind these manipulations is to create conditions comparable to that in a colony from which a swarm has issued (parent colony), or comparable to conditions existing in a swarm.

**The Removal of the Queen.**—In a parent colony (from which a swarm has issued) there is no queen and the young bees have been notably reduced, though many fielders away in the field swell the proportion of the older bees. To create a somewhat similar condition artificially, it is only necessary to remove the queen, most of the frames of capped (sealed) brood, and adhering bees. When it is desirable to keep the old queen, she, and the frames of capped brood with the adhering bees can be put in a separate hive with a reduced entrance and used for increase. This is particularly advisable in one or two colony apiaries where the failure of a young queen might prove serious. Such a procedure is satisfactory during the early part of June with a colony which has set itself to swarm, providing all queen cells are destroyed and a new queen is given in ten days after the queen cells, which have developed in the interval, have again been destroyed. If this is done during the first week in June the increase will build up for the winter, but should be requeened in August. When it is felt wise to remove the queen later in the season, two frames of capped brood, together with the adhering brood, will form a successful nucleus to nurse the old queen along till the young one has proved her value. When increase is not desired, kill the old queen when the young queen has proved herself and unite when the flow is on.

There are many variations of the above, but for certain success the queen cells must be destroyed and a period of about nine days elapse (during which no eggs are laid) before the reintroduction of the old queen, or more preferably, a new queen. Such a break in egg laying should be avoided if possible by the early use of preventive measures.

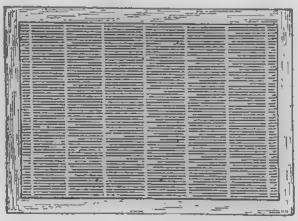
The removal of the sealed brood is not common, except in the production of comb honey. Then the unsealed brood is removed when the main flow starts and given to a colony which is run for extracted honey, or given to a young queen together with the adhering bees and used for increase. The parent colony, which is run for comb honey, has ten frames of largely sealed brood, and if it shows signs of swarming, the queen is caged for ten to fourteen days. Caged queens are usually replaced if the colony is to be wintered.

**The Demaree.**

Undoubtedly the most popular method of handling a strong colony preparing to swarm is the "Demaree." This is a method of separating the queen and the brood, and, as it does away with need for an extra cover or lid and an extra bottom, as well as keeping the whole force in the same hive, should be deservedly considered before the foregoing methods unless increase is desired or the beekeeper is not certain whether he is dealing with supersedure or swarming.

The Demaree, as commonly practiced, is as follows:

Confine the queen to the lower brood chamber, by means of the queen excluder on 5-9 frames of sealed brood, and empty combs, after making certain that all queen cells have been destroyed. Now put on the empty and then the partly filled supers of honey. Above the supers place the unseald brood (not less than 5 combs, hoist sealed brood if necessary), making certain that no queen cells are present. Four or five days later examine this top chamber of brood for queen cells.



**(Fig. 8.)**
**Wire Queen Excluder**

If one desires to re-queen when a colony is Demareed, the following modification is suggested. Reverse the position of the brood chambers, placing the sealed brood and the queen above the honey supers, and the unsealed brood and one queen cell below. In this way the young queen is less likely to be lost when returning from the mating flight. A queen excluder is placed below the brood chamber with the old queen.

A Demaree controls swarming definitely for sixteen days, and usually by that time the swarming season is over.

## HIVING A SWARM

**Equipment:**

A hive complete with nine combs or frames of foundation.
A white cloth or newspaper in front of the entrance.
A wide open-meshed sack, or box, or bushel basket to hive swarm.
A smoker and a veil.

A prime swarm normally settles on a branch or some other support within a hundred yards of the hive from which it emerges. It remains there from fifteen minutes to upwards of eighteen hours and then leaves for a new home. Once a swarm leaves its resting place it is apt to go a considerable distance.

**Methods.**—If the swarm takes the form of a pendulous drop it can readily be jarred in a sack or bushel basket, etc., and can be carried to the new hive and dumped at the entrance. The white cloth or newspaper makes it easy to see the queen, and a few puffs of smoke will soon cause the marching mob to enter the hive. Usually there is no further trouble once the queen enters, but it is a common practice to cage the queen till the next day or give the swarm a comb of unsealed brood to prevent them from absconding. The queen cage is placed just inside the entrance of the hive.

Swarms that settle on high boughs may be jarred loose and caught in a sheet. Sometimes if the tree has no great value the branch may be cut off.

**Swarms on Fence Posts.**—Usually it is well to set the new hive against the post. The hive should contain a comb of unsealed brood and two or three empty combs or frames of foundation. Remove the cover and fold a sack over the top of the frames leaving the empty part of the hive uncovered. If you see the queen take her up gently by the wings and cage her, and put the cage into the hive. Then gently work a piece of pliable cardboard, or small fire shovel, between the clustered bees and the post, dropping them into the hive when the cardboard or shovel is fairly full. As soon as they begin to run, cover the hive with sack and dump the rest of the bees in front of the hive. If the queen is not seen it will be necessary to watch for her every time bees are dumped into the hive or in front of it. If by any chance she does not enter the hive, the bees are likely to abscond. When the queen is in the hive and most of the bees are down, the rest can be smoked and brushed off the post with little ceremony.

**Transferring.**—Bees often enter the walls or roofs of buildings; it then becomes the duty of the beekeeper to either remove or destroy them.

When the bees are thought worth saving, the following method has proved satisfactory.

Close all cracks by which the bees gain entrance to the building, except one, cement or plaster of paris will be found very satisfactory. Over the only entrance left for the bees, fasten a Porter bee escape, top side in, so the bees can come out but cannot return, or tack a wire cone 3 inches in diameter at the base and 8 inches long. At the tip leave an opening just large enough to let the drones out. Now place a hive containing a nucleus consisting of a queen, two frames of brood and hovering bees and eight empty combs, so its entrance is at an angle of 45 degrees with the bee-way into the building. As night comes the fielders will be forced to enter the nucleus and it will build up rapidly. In five or six weeks the colony in the building will consist of the old queen and a handful of bees. Kill these some evening with sulphur fumes or cyanogas, and let the bees of the nucleus rob out the honey the next day.

Where a scaffold is necessary to bring the nucleus up to the entrance, care should be taken to build it so well that it will support a weight of five hundred pounds, as the beekeeper will have occasion to work on it. It is well to arrange to lower supers by means of rope; going down the ladder with a super on one's shoulder is not to be recommended.

## REQUEENING AND MAKING INCREASE

In rearing queens for requeening or for the purpose of making increase, the beekeeper must consider:

1. The effect on the honey crop of the parent colony.
2. The chances that the increase has of wintering.

The simplest method of requeening is to remove the queen from a colony and place her with most of the capped brood and adhering bees in a new location. The dequeened colony will promptly develop a number of emergency cells, which will later produce queens. Nine days after the queen has been removed, all cells but one should be destroyed or, if they are to be used in other colonies, should be carefully cut out of the comb, with at least an inch of the honey comb adhering to the cell and this pinned by means of a small finishing nail to the side of a brood comb in the increase being made or in a queenless colony. This method of queen rearing gives only average queens.

A common practice is to take swarm cells, such cells usually producing good queens.

Probably the best system is to place an empty comb in the center of the brood nest of the best queen in the yard. Three days later rmove this comb, which should have in it a large number of eggs, and put it into a strong colony from which the queen and all the combs containing eggs or brood have been removed (but not the adhering bees). The queen is usually killed and the brood given to colonies that can care for it. This colony being without a queen and brood of any kind will, especially if fed honey or sugar-syrup in a feeder, produce excellent queens. These queen cells should be taken out on the ninth day, as indicated above, and the colony united with some other colony, or given three frames of sealed brood and a new queen.

Commercial methods of queen rearing are outlined in all manuals on beekeeping.

**Methods of Increase.**

The following methods have proven very successful in the Dominion Experimental Farm, Lethbridge, of which Mr. H. T. Luther is head beekeeper:

**July 1-7: First Method—**

(a) Remove queen with most of the capped brood and adhering bees to new location.
(b) Re-queen parent colony.
(c) Replace old queen if over 1 year old.

Effect on colony---Reduces congestion if flow is late.

Effect on honey surplus—Least loss with late flow.

**July 1-7: Second Method—**

(a) Remove old queen and 2 combs capped brood with adhering bees to new location.
(b) Destroy all queen cells.
(c) Nine days later re-queen parent colony.

Effect on colony—Checks swarming for season.

Effect on honey surplus—May increase yield if swarming impulse very marked.

**Second Week of Flow: Third Method—**

Where two brood chambers are used, remove top chamber for increase, giving it all unsealed brood and leaving sealed brood with parent colony. Give this a new queen.

Effect on colony—Swarming rarely attempted in parent colony. If necessary, cage old queen and requeen parent colony in 10 days.

Effect on honey surplus—Excellent method for comb honey.

## THE INTRODUCTION OF QUEENS TO NORMAL COLONIES

The observance of the following steps will do much towards safe introduction of queens:

1. Make certain the colony to be requeened is queenless.
2. Destroy all queen cells.
3. Feed the colony before introducing the new queen unless there is a heavy honey flow.
4. If a cage is used, place it where the bees would expect to find a queen.
5. Do not disturb the colony for ten days after requeening.

**Virgins.**

1. A virgin or queen which has not been mated can be run in the entrance a few hours after the colony has been dequeened. Usually the beekeeper sends a puff of smoke into the entrance ahead of her and another after he has placed the virgin at the hive entrance.

2. When the shipping cage is used for introducing, it is best to remove the workers which accompany the queen by removing the perforated metal which closes the hole in the end away from the candy. This can be most readily done by holding the cage before a closed window. The bees will go towards the light, and by closing the opening in the end of the cage with the finger when the queen tries to get out and removing it as soon as she turns away the workers will soon leave the cage. Should the queen get out, get all the workers out of the cage, and then either place the cage screen side to the window and herd the queen into it or pick her up by the two wings (never press her abdomen) and run her in. After the queen is in the cage close the entrance into the cage with a bit of wax or a small stick and rmove the paper from the other end, but do not bore through the candy. Let the workers out by opening the window and take the cage to the hive. Hang the cage, candy end down, by means of a wire between two combs in the center of the brood nest, making certain that the workers have access to the screen side of the cage and the hole filled with candy so they can eat their way in. (These precautions should be taken with package queens if they are used for packages other than those they are shipped in.)

**The Push-in Cage.**—This is one of the safest methods of introduction. The cage is made from a piece of ordinary window screening about 2½ inches square. Cut a half-inch square out of each corner and turn up the four rectangles till their edges meet and an open box is formed. Now take a comb from the hive to which the queen is to be introduced, and allow the queen to run out on it; put the push-in cage over her and move it carefully to the place desired, keeping the queen confined beneath it. Here push the edges of the cage firmly into the comb. When possible the cage is placed over sealed brood about to emerge. The objections to this method are the injury to the comb and the destruction of brood when the cage is pushed into place, but this is a small price to pay for safe introduction.

**The Queen with Nucleus.**—When a queen in a nucleus is to be introduced, dequeen the colony to be requeened, remove as many combs from it as are contained in the nucleus from its brood chamber and feed. About six hours later place the entire nucleus on its own combs into the colony so prepared, taking reasonable precautions that the queen is not on the comb next to those of the colony into which she is introduced, and if the work is done quietly and rapidly the introduction will be successful.

**The Introduction of Queens to Abnormal Colonies.**—The requeening of hopelessly queenless colonies, laying worker colonies and colonies which have had a drone-laying queen for some time is usually a waste of time. The most profitable practice is to unite such colonies with queen-right colonies, and restore the number of colonies by making increase. Where for some reason—a single colony apiary, fear of disease, etc.—requeening is desirable, the following methods are suggested. None of them are certain to be succssful, and if succssful, are rarely as satisfactory as uniting.

**Laying Worker Colonies.**—A laying worker colony is one which has been queenless or headed by a very poor queen for over a month. The eggs laid by laying workers

are found attached to the sides of the cells, not in the bottom, and usually there are several to the cell. The brood is distributed in patches throughout the comb, and is usually all drone, though at times a little worker brood may be found if the old queen is still laying or has been laying within three weeks of the time of examination.

**Method 1.**—Carry the laying worker colony about 100 feet from the old stand and place a nucleus consisting of a queen and two or three frames of brood in all stages in a hive on the old stand, leaving the entrance wide open. Now return to the laying worker hive and shake the bees from the combs into the grass and carry the hive and combs away, later washing out the combs (see washing combs).

The bees shaken out on to the grass will return to the old stand, and finding normal brood and a queen, usually accept her. The laying workers are very slow to return, and when they come in are supposed to be killed by the normal workers.

2. A second method is to give the laying worker colony a comb or two of normal brood and a ripe queen cell or queen two days later.

3. Where the apiary cnsists of only one colony a queen is sometimes successfully introduced by feeding the colony heavily for two days, shaking the bees out as in Method 1, returning the hive to the old stand, and placing the queen in a push-in cage on a central comb.

## COMMON APIARY PRACTICES

**Spring Work.**

The first examination of a wintered colony should be made as early as the weather will permit. All entrances should be cleared of dead bees. Any hive in which the colony is dead should be removed or have its entrance closed to prevent robbing, and the possible spread of disease. The entrances of weak colonies should be reduced to an inch.

One should be careful not to disturb a cluster, but a glance will enable one to tell the strength of a colony and note a shortage of stores. A comb of honey or some candy will tide a colony over till a thorough examination is possible.

The next examination is made when the weather has settled and at a time when the bees are flying. The following conditions may exist:

**A Shortage of Stores.**

Each hive should have from twenty-five to thirty pounds of honey. If there is a shortage, give combs containing honey or sugar syrup or feed using a pail or other inside feeder. When possible, let every colony have a comb of pollen. Brood rearing is not carried on without pollen.

**Weak Colonies that Need Stimulation.**

Any colony which does not cover three frames may be regarded as weak, and queenless colonies should be united with such colonies. Weak colonies well packed survive, but tend to build up on the flow. They are a dead loss financially to all but experienced beemen, unless united with average colonies.

**Queen Cells.**

The shape and position of queen cells often indicate the condition of the colony in relation to the queen. **Queen killed:** Queen cells are nearly always on the face of the comb. They are emergency cells and are not as nice as the regular supersedure cell, being smaller in diamter and shorter. **Failing queen:** Little worker brood and that scattered. One or two fine large queen cells broad at the base, well pitted with wax. A colony superseding their queen gives every attention to the queen cells, and excellent queens usually emerge. **Swarm cells:** Many in number; a few on face of comb, mostly in holes on sides and at base of comb. Bees usually idle. Congestion of bees in brood nest or supers, or both, and lack of storage or brood space. All unwanted queen cells should be destroyed when found.

**Feeding.**

Ordinary five or ten-pound friction-top pails are used. Twenty or thirty holes are punched in the lid with a lath nail. The pails are filled with sugar syrup. A newspaper or little clean piece of burlap or canvas with a hole a little smaller than the diameter of the pail is placed over the frames and the pail of syrup is inverted over the hole. An empty super is put in place, and two or three sacks are packed around the tin to conserve the heat.

**Uniting.**

Miller Newspaper Plan.—The colonies to be united are placed side by side. The cover of the queen-right colony is removed and one or two sheets of newspaper placed over the hive. (Make one or two slits in the paper with a knife.) The bottom

board of the queenless colony is now removed and the brood chamber is placed on the top of the brood chamber of the queen-right hive. The bees, with only a newspaper between them, will enlarge the slits in it and unite slowly without fighting. If there is no flow, it is well to feed both colonies before uniting.

**Stimulating.**

(a) When there is a dearth between the first flow and the main one, bees may be encouraged to continue brood rearing by feeding sugar syrup (one part sugar to five parts water) in a pail, which has only one or two holes in the lid. The bees get it slowly but steadily. An uncapped comb of honey may be placed in the second brood chamber which is placed below the occupied one.

(b) Where a colony is weak it may be placed over a strong colony with a double screen between and given a rear entrance. The heat from the colony below and the activity of the bees below will encourage the weaker colony. The double screen prevents fighting, and the entrances at opposite ends and different heights aid in checking drifting, or two queen excluders may be used and only one entrance provided.

**Drifting.**

Bees tend to drift more than the average beekeeper imagines. A heavy wind, the moving of a hive or the change in appearance of a yard, such as is caused by the removal of packing cases, will increase drifting. Young bees out on their play flight often drift and are passed by the guards. Older bees are usually driven off unless they carry a load of honey. A fair distance between hives—16 feet between rows, and 10 feet between every hive or pair of hives in the row—helps to check it.

**Robbing.**

All bees will rob in times of dearth if given a chance. A piece of honey comb left outside will lead to an assault on the nearest hive, and if weak, the hive will be robbed out and the colony killed. Queenless colonies lack courage and are easily robbed. Once started, robbing is difficult to check. The bees single out some colony and all go after it, then they go after a second and third till the beekeeper is at a loss. The removal of a weak hive to the cellar for the day when attacked, or changing its position with a strong hive of robbers is often necessary. Reducing entrances to one bee space and throwing grass in front helps. A cloth soaked with diluted carbolic acid is effective if thrown into the hive, but do not let it close the entrance.

**Supering.**

The bees should occupy all of the first and at least six combs of the second brood chamber before adding the super. The first super is usually added when the bees build spurs of wax, or when new white capping appears at the tops of the frames.

The second super is added when the first is half-full. The new super is placed next to the top brood chamber, if the flow is expected to continue, and above the partly filled super if the flow is about over, or if the flow is very slow.

**Candy.**

Mr. C. B. Gooderham, in "Bees and How to Keep Them," recommends the following if through some error in management bees require feed when it is too cold to feed syrup:

No. 1: Dissolve 3 lbs. of granulated sugar in one pint of boiling water. After it is dissolved, bring to a boil over a slow fire and boil till it reaches 280 degrees Fahr. or when the candy will form brittle strings when dropped into cold water. Pour into moulds and allow to harden. Do not disturb the candy after pouring or scrape it from the dish in which it was boiled into the mould or it will crystallize. When hard the candy should be a light amber in colour and transparent.

No. 2: The following, known as Good's candy, will be found easy to prepare:

1 pint of honey( never use honey of unknown origin).
4 pounds of powdered sugar.

Heat the honey to 140 degrees Fahr., stirring and adding the sugar till the mixture becomes too stiff to stir. Then place on a board and work in sugar till it is fairly stiff. Now cut in slices or squares and place in the hives where bees can reach them.

**Sugar Syrup.**

For fall feeding use two parts of sugar to one of water, heat the water to boiling point and stir in the sugar. Continue stirring till every crystal is dissolved. If the sugar burns, the syrup cannot be used for fall feeding with safety. In the spring or last fall, syrup is often poured into the cells of empty combs, and these are introduced next to the combs on which the colony clusters. More frequently it is fed in inverted tin pails with 15 or 20 holes punched in the cover with a lath nail.

**Washing Combs.**

Occasionally queens emerge from missed queen cells or escape from cages in the fall, and combs are found with brood after the colony has been killed, or it may be desirable to free combs from the brood of laying workers or drone-laying queens. According to R. H. Hawthorne, such combs can be readily cleaned by uncapping the sealed brood, hanging the combs on nails driven into a wooden fence or shed and directing a coarse spray of water from the garden hose into the cells. If reasonable water pressure is used, the dead larvae will be washed out and the combs uninjured. After washing, the combs should be widely spaced in a super (not more than 8 in a 10-frame super) and allowed to dry in a warm room.

**Removal of Pollen.**

Mildewed pollen can be removed from combs by placing them in a tub of warm water to which a cake of yeast has been added. After 24 hours the water should be shaken out of the combs, or they can be placed in the extractor. The pollen will either come out or be in a form which is easily removed by the bees. Dry the combs as indicated above.

## SECTION VII.

# BEE DISEASES

No serious adult bee diseases are prevalent in the Province, and they are, therefore, not discussed. Should large numbers of adult bees be noted crawling around the hives unable to fly, shivering and clinging to blades of grass and later dropping to the ground to die, notify the Apiculture Branch, Edmonton.

**American Foul Brood.**

American Foul Brood is the most serious of bee brood diseases. It is caused by the spore-forming Bacillus larvae which enters the body in the food during the period of larval feeding. According to Sturtavent, it cannot germinate and grow until the sugar content of the body drops below 4%. This does not usually occur till the end of the feeding period, and for this reason larvae which die before sealing are very rare, but starved or underfed larvae can be killed while still in the coiled stage.

The incubation period of Bacillus larvae is 24 to 48 hours, so that the Bacillus does not normally kill the larva (baby bee) till it has finished spinning its cocoon and lies stretched out in the cell. The amount of infection and varying conditions in the body of the infected larvae may hasten or check the growth of the bacterial infection, so that the age at which the bee is killed by this disease ranges from the late larval on into the pupal stage.

Since the cell is sealed over or capped at the time of disease, the first symptoms of the disease are rarely observed by the beekeeper. By the end of the first week after death the whole body will have lost its plumpness and the head and adjoining parts changed from the normal bluish-white color to a gradually deepening yellow or into a light brown. During the second week the head turns a deeper brown, and the brownish colour gradually expands through all parts of the body. At this time the body contents have the consistency of soft cheese or dough.

During the third week after death the bees usually pierce or remove the cell capping, and the deep brown color and the ropiness usually associated with the disease appear. This particular Bacillus creates conditions which prohibit the development of other forms of bacteria. The symptoms are reasonably constant. The colour of the dead larva is usually that of a dark brood comb, but it may still be yellow. It lies as if it were flat on its back. There is usually no evidence of organs, but occasionally the trachea, or breathing tubes, appear as white lines. The part of the body nearest the mouth of the cell shows signs of drying down, and a toothpick inserted into the mass will carry with it, when withdrawn, a thread much like that formed if a toothpick were withdrawn from a pot of glue. As time goes on, the mass dries down into a scale. This scale appears as a very thin, rough-surfaced film and adheres tightly to the cell wall. If the bee reaches the pupal stage before death, the head pulls back and the so-called tongue is seen sticking up toward the roof of the cell.

**Control Measures.**—A colony affected with American Foul Brood is killed with Cyanogas when the bees are not flying, and then the bees and the combs are destroyed by fire. The hive body and supers may be flamed with a blow-torch, after carefully scraping all wax from them, or cleaned by immersing in a solution of lye water (1 can of lye to 5 gallon of water). The bees and combs of the infected colony are always burned in a pit in which a roaring fire has been started and the pit filled in after the fire.

The burning of honey and brood-filled combs is not always an easy matter, and the pit used must be deep enough to permit the burial of all infected material which might escape destruction by fire. Where a single colony is to be burned a pit is usually 18 inches deep by two feet square. The empty combs are first thrown on the fire and then the dead bees and the brood and honey-filled combs. Frequently two iron rods forming a support for the combs are placed across the pit to prevent the combs from falling directly on to the fire and more or less quenching it. After the fire is down to glowing coals, throw in any earth which may have been smeared by falling combs, and then fill in the pit. Where more than a single colony is destroyed the pit should be larger, and an effort should be made to get a good draft by digging the pit or trench so the wind will pass through it.

The destruction of the colonies showing the disease is not evidence of the end of the disease. The amount of hidden infection will depend upon the interchange of supers and brood combs throughout the apiary. Usually an apiary can be freed from disease in three or four years, if the owner is alive to the situation and realizes every colony has been exposed to infection, either by drifting bees or the interchange of equipment.

The beekeeper deals with a hidden enemy. The spores (seeds) of the disease may lie hidden in any cell of honey, in living brood or in dead brood still concealed by the capping. The disease may show up in any colony the day after inspection, a week later, or during the following year.

Spores have been known to cause the disease after lying in unused comb for 40 years, and certain A.F.B. spores are said by Dr. Hambelton to have resisted boiling for five hours. The prevention of the spread of the disease to healthy colonies is completely in the hands of the owner. All the bee inspector can do is to indicate the symptoms of the disease and burn the colonies showing infection at the time of his visit. The following indicate the type of precaution necessary:

1. Do not open colonies when there is danger of robbing.
2. Wash your hands and cleanse your hive tool with soap and warm water before opening the next hive, or at least jab it into the ground until all honey and wax have been removed from it.
3. Avoid the exchanging of brood and super combs, even when both colonies appear disease free. Feed sugar syrup rather than combs of honey.
4. If colonies must be united, unite but never equalize colonies, by passing combs of brood from one colony to several others.
5. Examine all colonies carefully for the disease: (a) before putting on supers, (b) before removing honey; (c) send us a smear on glazed or waxed paper of any dead larvae which appear to have been infected.
6. Return all supers as far as possible to the colonies from which they were taken.
7. Keep the queen excluder on the colonies at all times, to make certain the queen never gets into the supers.
8. Put all bits of wax into a covered pail, and render as soon as possible.
9. When looking for queen cells, shake the bees into the hive if you find them too thickly clustered on combs—not on the ground.
10. Make certain the honey house is bee-tight, and that the bees cannot reach waste water containing honey.
11. If you winter colonies watch for weak or dead colonies in the spring. A single weak or dead colony having A.F.B. will infect every colony that helps to rob it.
12. If you plan to kill bees, cage all queens the last week in July and kill with Cyanogas, shaking the dead bees into a large pit and then fill it in. Return each comb to its own super or brood chamber. Store these combs in a bee-tight room or cellar. If certain brood chambers lack honey, feed more sugar syrup.
13. It is well to number brood chambers, supers and combs to avoid any possible exchange.
14. If the above methods cannot be carried out with the colony, they should at least be carried out for each out-yard and the out-yards run as distinct units.

**European Foul Brood.**

European Foul Brood is occasionally found in package colonies which have been subject to unfavourable conditions, but more frequently in weak, over-wintered black or hybrid colonies, especially in northern districts with acid soils. The disease is probably a mixed bacterial infection, though it is generally believed the primary cause is a non-spore-forming bacillus (B. pluton.). Numerous decay bacteria enter after death and the appearance and colour may vary widely. It is rarely serious if the colony is strengthened and given plenty of sugar-syrup. Where a colony is definitely hybrid, it should be requeened. The majority of infected larvae die when four days old. At this time they lie coiled in the bottom of the cell. After death the plump appearance is lost and the color changes from white to yellow or gray and

then to black. The consistency of the moist remains is usually paste-like, though there may be slight roping.

The disease is readily distinguished from other brood diseases if the larvae killed before sealing are left in the cells, but should they have been removed by the bees, and the beginner finds only larvae killed after sealing, the problem may well be difficult. He should wrap any dead larva, of which he is suspicious, in waxed paper and send it to the Apiculture Branch for identification. Death from E.F.B. never occurs in the pupal stage.

The scale formed by the dried-up larval remains is smooth with a silky gloss and readily removed from the cell. The larva is active at the time of death, and may have assumed any shape. When moistened with water the scale usually becomes pasty, and solid bits of tissue are noted. The scale is rubbery and, when broken, appears granular in cross-section.

**Sacbrood.**

This is the most common disease of bees. It is said to be caused by a filterable virus, and is usually a transient condition associated with unfavorable conditions, though certain queens seem to carry factors favourable to its production. In rare cases, a colony needs to be requeened.

Sacbrood is at times confused with American Foul Brood, since infected larvae are killed by both diseases during the same period of development. There is a paste-like stage through which Sacbrood passes when drying down, which is readily confused with the dough-like stage of American Foul Brood. Further, the partly eaten remains of larvae affected by both diseases are similar in appearance and sometimes in colour. However, Sacbrood is never sticky, and the larva in the moist stages, with its tough skin and the head section looking like a black knot, is well likened to a sack full of a watery fluid with some white meal in it. The scale is always loose in the cell, and usually falls out when the comb is tipped and shaken.

Occasionally Sacbrood does not kill until the pupal stage is reached. Sacbrood scales are loose and the head section rises up from the cell and bends in over the body. It never shows a tongue, as do pupae killed by American Foul Brood.

## DIAGNOSIS

**Symptoms in Larvae Indicating Likely Cause of Death.**

In the following table it will be noted that there is no clearly defined group of symptoms which enable one to determine the cause of death in every case in the field. The most highly significant characteristic symptoms are printed in italics, and when found enable anyone with experience to determine the disease. Less common symptoms which have not been indicated may confuse the beekeeper, and the rare cases of European Foul Brood, which are very much like American Foul Brood and later form a scale much like American Foul Brood, can only be distinguished by a microscopic or a laboratory examination.

The beekeeper should make a smear of the suspected larva on waxed paper, or enclose the scale in a bit of waxed paper, and mail it in a letter to the Provincial Apiarist, Department of Agriculture, Edmonton, for microscopic examination, first determining in his own mind what the disease is. In this way his knowledge of abnormal conditions will be built up.

**Prevalent Bees Diseases**

| NAME | A.F.B. | E.F.B. | SACBROOD | NO SPECIFIC NAME |
|---|---|---|---|---|
| DISTRIBUTION | Scattered | Scattered | Scattered | *All larvae in area dead* |
| CELL | Capped | *Uncapped* | Capped | *Both* |
| MAJORITY OF DEAD ARE | Advanced larvae, some pupae | Usually young larvae, some advanced larvae, *never pupae* | Advanced larvae, rarely pupae | All stages |
| POSITION IN CELL | Stretched out on lower wall, *uniform position* | *Coiled in bottom of cell,* if older, body usually twisted | Stretched out on lower wall, *head remains erect* | Any and all positions |
| APPEARANCE | *Melted down* | Greasy mass | *Small sack* | Soft, rotten |
| MARKINGS | Rarely tracheae show as white lines | Tracheae *white lines like spokes in a wheel* | *Segmental markings retained till well dried* | Wide variation |

**Prevalent Bees Diseases**

| NAME | A.F.B. | E.F.B. | SAC | NO SPECIFIC NAME |
|---|---|---|---|---|
| CONSISTENCY | *Strings like glue* | Number may draw out | *Never strings, watery* | *Never strings* |
| SKIN | Tears readily | Tears readily | *Tough wrinkled* | Tears readily |
| ATTACHMENT TO WALL | *Sticks to cell wall* | Easily removed | Easily removed | Easily removed |
| COLOR | Yellow to dark brown | Greyish-brown to black | Variable | Variable |
| | | SCALE | | |
| POSITION | *Attached to lower wall* | Unattached | Unattached | Unattached |
| CONSISTENCY | *Thin, brittle* | Thicker, rubbery, granular | Thicker, often hard granular | Variable, but does not snap off like A.F.B. |
| CAUSE | B. larvae | B. pluton | Filterable virus | Cold, heat, starvation, etc. |

**Killing of Bees.**

When colonies lack young bees, feed or the apiary location makes it unprofitable to winter bees, the colonies should be destroyed as soon as the flow is over. The common practice is to cage the queen (usually the first week in August) three to five weeks before the flow is over, and so prevent further brood rearing. The bees are killed when the flow is over (about Sept. 10th), or when the first black frost occurs. They are brushed off the combs and these are carefully stored until required in the spring when the apiary is re-stocked with package bees.

**Caging Queens.**

A "Modified Miller Cage" made by wrapping a piece of ordinary window screening, 4½×3¼ inches, around a block 4×¾×½ inch. As soon as the screen has been neatly fitted around the block, pull the screen forward and insert a block 1½×¾×½ inch for half its length and fasten the screen to it with a small tack. Keep the other end from unfolding, by wrapping a No. 28 wire three or four times around the screen ½ inch back from the other opening. Remove the block on which the screen backs were formed and insert a block similar to that at the other end, but usually 2 in. in length, to act as a stopper. When caging the queen, pick her up by her two wings and let her run up into the cage after removing the stopper. As soon as she is inside, fit the plug in and hang the cage between two combs in the brood chamber, making certain that the screen part of the cage extends down between the combs and can easily be reached by the bees who will feed the imprisoned queen. Nine days after caging the queen the combs should be carefully gone over and all queen cells destroyed. If this is done thoroughly no further examination of the colony is necessary.

**Dead Larvae.**

Occasionally, a queen cell will be missed and a virgin queen will have established herself in the hive where the queen has been caged. The combs of such a colony will be found to contain several patches of brood in varying stages of development. Such patches should be allowed to hatch out before killing the bees, or may be washed out after killing. See Washing Combs.

**Killing the Bees.**

The most commonly used chemical for killing bees is cyanogas. The American Cyanamid and Chemical Corporation recommendations regarding the use of cyanogas, as expressed in a letter written Feb. 7th, 1938, to this Department are as follows: "We do not recommend the use of a foot pump duster for the application of Cyanogas A-Dust in killing bees in hives. We do recommend the use of Cyanogas G-Fumigant, however, and this grade should be used to destroy bees in hives, in the manner indicated in our Cyanogas leaflet No. 835, viz., simply spread a tablespoonful of Cyanogas G-Fumigant evenly on a cardboard and slip into the entrance of the hive at the bottom. Do not use Cyanogas A-Dust for this purpose. While the lethal gas which evolves from Cyanogas will not hurt the honey, the dust will if it comes in contact with the honey. It will be necessary to use Cyanogas A-Dust and a suitable duster to kill swarms of bees behind walls of inhabited houses. An ordinary hand duster of the agricultural type will suffice for work of this kind, but such a duster is not suitable for large scale operations, such as the control of gophers for example."

"The small amount of Cyanogas required to be blown into the walls of inhabited houses where swarms of bees have established themselves should cause no discomfort to human occupants, although we would recommend complete evacuation of the premises for several hours after the fumigation (see specific instructions covering enclosed space fumigation in Cyanogas Leaflet No. 835), and occupants should not return until the premises have been thoroughly aired. It is always best to be on the safe side when handling poisons of any kind."

## APIARY PESTS

**Ants.**

Calcium cyanid (Cyanogas) is most commonly used to destroy ant nests in an apiary. Drive several holes into the nest 2 or 3 inches apart and 6 to 9 inches deep. Insert a piece of pipe or a funnel into the hole so as to insur the cyanogas reaching the bottom, and pour a teaspoonful of cyanogas into each hole. Cover the hole over after removing the pipe or funnel used. Cyanogas is a poison, handle with care and do not inhale the gas given off.

Carbon bisulphide can be used. Pour a teaspoonful into three or four holes made with a sharp stick in the top of the ant hill, close each hole at once with earth and cover the ant hill with wet sacks or a wet blanket.

The following syrup has been found effective in destroying Ants, when it is not convenient to get at the ant hill:

| | | | |
|---|---|---|---|
| Sugar | 1 Pound | Arsenate of Soda | 125 Grains |
| Water | 1 Pint | Honey | 1 Tablespoonful |

Boil the first three ingredients till the arsenate of soda is dissolved, then add the honey. Punch holes in the top and sides of cans of suitable size, with a spike. Soak bits of sponge, excelsior or bread in the poison and put in the cans. Then put on covers. Place these where it is convenient for ants to get at it. If too much poison is added to the syrup the ants will not take the syrup. This is a slow acting poison, and will be carried to the nest and fed to the ant larvae and queen.

The Mediterranean Flour Moth larva eats the pollen and spins cocoons and webs over the face of the comb. The pinkish white larva is commonly found on stored comb, but not regarded as dangerous.

**Skunks.**

Break a small hole in the air space at the top of an egg, insert a piece of nail or wire and stir in 2 or 3 grains of strychnine. A bit of gummed paper may be pasted over the opening, but it is more frequently left open. The treated egg is now half buried at the front corner of the hive. Care must be taken to prevent farm animals and farm birds from getting it.

**Mice.**

Dissolve ten grains of strychnine in a pint of water. Put this into a quart sealer filled with wheat and shake till every grain is wet. Remove lid after an hour and leave in a cool place over night to let grain absorb strychnine. Then spread out on paper to dry. When dry pour back into sealer and mark the bottle "POISONED GRAIN." In the fall, when packing bees, put a small quantity in tin lids on the top of the packing of outdoor wintered colonies and other places where mice may run. This grain will kill chickens and other farm animals.

### TROUBLE CHART

Below are given some of the more common conditions requiring correction. The beginner is well advised to add to this such other conditions as may come to his notice, till he is familiar with all manipulations.

| Condition Found | Most Probable Causes | Remedial Measures (Self-evident Measures are not Indicated) |
|---|---|---|
| Package queen not out of cage after 5th day. | Look for eggs and another queen. See if exit is blocked. Workers cannot get to screen side of cage. Queen dead. | Give frame of eggs and brood. Wire for queen. |
| Bees in package cage after 5th day. | Too cold. See if queen is in cage. | Shake bees out of cage and look for queen. |
| Feed can full. | Feed holes plugged. If weather is too cold bees cannot take syrup. Honey flow. | |
| Majority of cells of sealed brood have high dome-like capping. | Drone laying queen. Poor comb. | If drone layer, kill her and introduce new queen. |

| Condition Found | Most Probable Causes | Remedial Measures (Self-evident Measures are not Indicated) |
|---|---|---|
| Queen missing. Small patches of eggs irregularly placed in cells, often on side of cell. | Laying workers. | Unite with strong colony, or give frame of eggs and brood and introduce queen two days later. |
| Bees covering less than three frames. | Poor wintering. Drifting.<br>Failing queen.<br>Disease. | Unite with medium strong colony, or strengthen with package bees.<br>If A.F.B. kill bees and burn. |
| Patch (less than 3 inches square) of brood. | Lack of pollen; honey; failing queen; too few bees; too cold. | Unite or give new queen.<br>Give protection by wrapping with tar or building paper. |
| Dead larvae at hive entrance. | Too cold or<br>Too hot (unusual in Alberta).<br>Split brood nest.<br>Poison from sprays or grasshopper poison. | Protection or more bees. Do not change the order of brood combs.<br>E.F.B. or Sac. |
| Brood irregular. Queen cell on the face of the comb. | Supersedure. | New queen, and frame of brood. |
| Less than 4 combs of honey. | Severe winter; much brood, dearth, etc. | Feed. |
| Sealed or unsealed dead brood; skin tough; contents watery. All shades of white, gray and black. | Sacbrood | Usually rights itself. If very bad give new queen or unite. |
| Solid areas of dead brood in all stages, mostly black in color and watery. | Chilled brood.<br>Overheated brood. | Avoid spreading brood nest.<br>Give protection. |
| Sealed dead brood ropes out. | American Foul Brood. | Kill bees with cyanogas.<br>Burn<br>Mail small sample to Apiculture Branch, Dept. of Agriculture, Edmonton.<br>Burn bees, combs and honey. |
| Chiefly unsealed dead brood. Does not rope. Breathing tubes show as white lines. | European Foul Brood.<br>Bacillus Pluton. | Unite, feed and give Italian queen. |
| Adult bees walk out of hive shaking wings, die in clusters, often shiny black looking abdomens. | Nosema. | Strengthen colonies. |

**Disease.**—The beginner is advised to send a small piece of comb containing the dead larvae or abnormal condition to the Provincial Apiarist, Parliament Buildings, Edmonton, in a match or other cardboard box. If there is honey in the comb, wrap the comb in wax paper before putting in a tin box having a tight lid. If only one or two larvae are found, take a toothpick and make a smear of the larvae on wax paper, such as used for butter or around bread, and enclose it in an envelope together with your name and address, and the results of the diagnosis will be sent to you. In this way the mutilation of combs is avoided.

## SECTION VIII.

# REMOVAL AND CARE OF HONEY

### Extracted.

Honey packed by the bee in a new waxen cell with its little waxen cover is a perfect article. No beekeeper can improve it. He simply takes the honey from its six-sided container and puts it into a larger one. On him falls all the blame for foreign bodies in the honey. The placing of a high-class article on the market is determined by the care taken. This care begins with the condition of the combs given to the bees. Combs which have been used for brood will yield a honey with small black specks. These specks are silk from the cocoons spun by the baby bees just before pupation. When the cell is uncapped bits of the cocoons are torn off by the knife, and their removal by any commonly used type of strainer is practically impossible. For this reason white combs should be used in supers when possible, and the queen confined to a double brood nest.

### Care of Combs.

Combs which have been carelessly stored often contain dust. The bees remove as much as possible, but sometimes they seem to regard the dust as pollen and store honey in a dust filled cell. Fortunately, no non-spore-forming bacteria can live in

honey for any length of time, but dusty combs should be washed, or better still, melted up. The same applies to frames with much brood or dead bees in the cells, though bees will clean up the combs, if not too bad, when used in the brood chamber. Such combs have no place in a super at any time.

The smoker is often the source of trouble. If green grass or leaves are not placed above the burning fuel to act as a filter, a certain amount of fine ash sifts down on to the comb and gets into the uncapped cells. There is little need for frequent examination of super combs, and usually little or no smoke is required in the early part of the season.

Too often the quilt placed above the super to prevent the bees from gluing down the lid is not as clean as it might be. Burlap or gunny sack is quite satisfactory, but should be thoroughly cleaned before being used. (The glue put on by bees is clean and makes a better seal.)

## REMOVAL OF HONEY

Practically all the bees will be out of a super within twenty-four hours when a bee-escape board is used, provided there is no brood in the super and room for them in the supers below. If the hive is crowded a super with empty combs should be placed below the bee-escape.

**Fig. 9.—Removal of honey with carbolic cloths. Note canvas lying on excluder ready to be placed on hive.**

### The Use of Carbolic Acid.

Pure carbolic acid diluted with water may be used to drive the bees from supers of honey in warm weather. Its use is not recommended by this Branch because of the frightful burns it will cause if carelessly handled. However, since it is so convenient, it will continue to be used, and we give below the common method of preparation and application. **Use leather gloves free from holes when handling the acid.**

1. Pure crystals (ordinary crude carbolic acid will taint honey) are melted in approximately 10% of hot water.

2. The solution is then poured into a clean vinegar, pop or some similar bottle. Insert an aluminium stopper such as is used for sprinkling cloths, in mouth of the bottle.

The carbolic acid solution is then sprinkled on pieces of canvas slightly larger than the top of the hive. The cover of the hive is removed and bees smoked down, a queen excluder put on top of the hive, and the canvas, sprinkled side down, is placed on the excluder, then the cover of the hive is replaced and left for three to

five minutes. If the weather is cool, lift the cover and a corner of the canvas and send in two or three puffs of smoke.

Frequently frames on which two or three thicknesses of cotton are stretched over frames made of 1×¾″ wood which fit nicely into a hive cover, are used instead of canvas. A second frame with a screen may be placed in the telescoping hive cover after putting the cotton screen in place. This does away with the need for a queen excluder.

It will take from five to thirty minutes for the bees to leave the super. If the carbolic cloths are left on too long the bees will be driven out of the hive.

**Brushing Bees.**

The tips of the bristles of the brush should be kept a little ahead of the back of the brush. In this way the bees are pushed ahead of the brush instead of being caught between the brush and the comb. Keep a pail of water handy so as to wet the brush frequently, otherwise the bees will be stuck fast and bruised by the brush, and the operator will be stung more frequently than necessary.

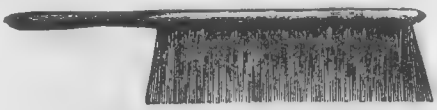


**Fig. 10.—Bee Brush.**

The super in which the brushed combs are to be placed should have a tight bottom, or stand on a tinned tray so as to retain honey which may drip from the combs, and keep out grass and dirt. It is convenient to place it toward the rear of the hive on the side the operator is working. A clean dish towel, about two feet square, with two pieces of broom handle attached to two sides is very convenient to throw over the super as it is being filled.

It is usually well to remove all the supers to be brushed from the hive and add the empty supers to the hive before beginning to brush.

Honey is more easily uncapped when warm. During the summer, extracting should be carried out as soon as the combs are removed to the extracting house. During the periods of extreme heat the wax may be a little too soft and will be easier to uncap the following day. In the fall, honey should be stored in a warm room (90 degrees) overnight, before uncapping.

**Uncapping.**

In uncapping a comb the lower side rests on a spike projecting about three-quarters of an inch above its support, the thumb of the left hand lies along the other side bar with its tip against the projecting top bar and the four finger tips press against the upper end of the top bar. The comb is tilted so that the capping, as removed by the knife, will fall into the container below. The capping should be removed from the full breadth of the comb, leaving a smooth even face. Draw the knife back and forth as it passes downward. Reverse the comb before attempting to remove the capping from the other side.

A clean super with galvanized screening tacked to the bottom will be large enough for apiaries up to five colonies. This, resting on supports rounded towards

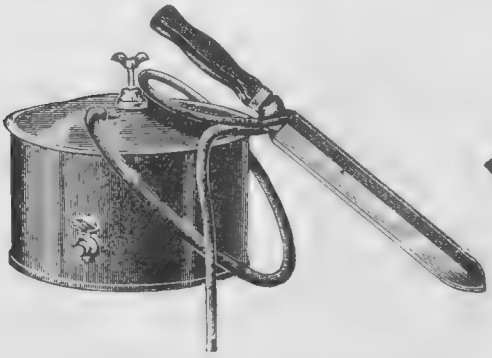


**Fig .11.—Steam-heated uncapping knife.**

**Fig. 12.—An uncapping knife.**

their ends prevent honey flowing along them, and placed on a large tub used only for this purpose, will prove very satisfactory. Large apiaries will require a larger uncapping box with a drain board or tin box-like tank below the screen.

A steam heated Bingham knife is most satisfactory, but two well sharpened butcher knives heated alternately in a deep can of boiling water can be used.

Cappings should be stirred frequently to drain. They may then be melted, and on cooling, the wax can be removed as a cake from the top. The honey below will taste of the wax and will be a little darker. It should NEVER be mixed with the rest of the honey, but used for cooking or sold separately.

**Extracting.**

Combs heavy with honey are easily broken. Start the extractor slowly and do not run at a high speed. Reverse the combs when the side being extracted is still half full of honey. Empty the other side and again reverse to get the rest of the honey. If the combs are warm and the honey heated through by standing on the hive or in a warm room overnight, extracting will be rapid.

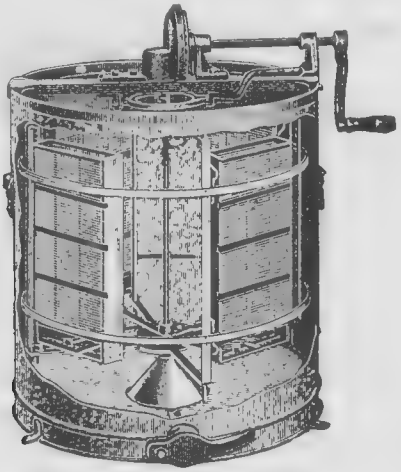


**Fig. 13.—Four-frame extractor.**

**Straining.**

Honey as it comes from the extractor will contain bits of wax, which must be removed. This is done by straining, by leaving in deep tanks and allowing it to clarify, or by a combination of the two methods. Local conditions will determine the methods used.

There are innumerable devices for straining. Probably the simplest method is to stretch a double thickness of cheesecloth over the honey tank and above it a piece of galvanized wire cloth window screening. Secure them by means of an iron band tightened by a bolt and burr; or a rope tightened by a piece of wood thrust through

**Fig. 14.—A storage tank**

and twisted. The end of the wood is usually secured by a cord to prevent any slackness.

Where deep tanks are not available, some method of straining is desirable. It should be remembered that every particle held back by a straining device reduces the area through which the honey can pass. Further, the finer the mesh the slower the honey passes through it and the harder the strainer is to clean. Therefore, it is wise to have the honey pass through a succession of strainers, each successive one having a finer mesh, and thus reduce the tendency to plug the finest screen. Finally, the secret of successfully using cheesecloth and other fine mesh materials seems to be warm honey and no interruption in the flow through the material.

Honey should stand for 24 to 48 hours in a warm room before pailing to let air bubbles rise, otherwise scum will form in the pail.

Stirring honey with a wooden paddle just before it crystallizes and then pailing tends to give a fine grained honey on granulation. The proper time for stirring most honeys is when the honey lightens in colour. This is often difficult to see. Care must be taken to avoid the introduction of air. The beginner will be well advised to confine his stirring to a few pails.

## CUT COMB OR CHUNK HONEY

This is comb honey from extracting frames cut in strips and wrapped in cellophane, or slipped into glass jars. When packed in jars the space not occupied by the cut comb is filled with extracted honey. There is a good demand for this pack, if properly put up, and the man with an apiary too small to warrant the purchase of an extractor will do well to market his honey in this way.

The best cut comb honey is produced in unwired shallow frames, but deep ones may be used. Light brood foundation should be used. Usually it is attached to the top bar by means of melted wax poured from a spoon. The melted wax must not be too hot. The best frames will be produced during the heavy part of the flow. As the flow declines, the bees will not build foundation into nice combs.

The combs should be removed from the hive as soon as completely capped, and stored in a warm, dry room that remains at a fairly uniform temperature. The entire comb should be cut from the frame with a knife and then cut into smaller pieces. The edges of the "cut comb honey" will be more attractive if the pieces are cut with No. 28 wire. A wooden tray formed of two laths with a number of boards each the size of the piece desired, and space a ¼ of an inch apart will provide drainage for each piece and make the cutting easy. A frame made with the wire properly spaced will enable one to cut the entire comb into sections with one motion after its removal from the frame.

Cut comb honey may be wrapped in cellophane or packed with extracted honey, in any type of glass or tin container. White glass pint or quart fruit jars are very satisfactory because of their wide mouths.

The extracted honey used in this pack should be heated to 145 degrees Fah. for 10 minutes and cooled rapidly down to 125 degrees Fah. At this temperature it will not melt the wax in the comb honey. It is well to run the extracted honey down the side of the jar to prevent air bubbles, and to lay tall jars on their side to prevent the buckling of the comb while cooling.

Honey should be cooled as rapidly as possible after heating to prevent the breaking down of the levulose.

The sale of full frames of well sealed honey is a common and profitable practice.

## HONEY

Honey contains three sugars—dextrose, levulose and sucrose. Of these, levulose is the most important in giving honey its distinctive value, and is 1.73 times as sweet as cane sugar. An analysis of honey indicates the following percentages:

| | |
|---|---|
| Water | 17.70% |
| Levulose | 40.50% |
| Dextrose | 34.02% |
| Sucrose | 1.90% |
| Dextrins and Gum | 1.51% |
| Ash | 0.81% |
| Substances difficult to determine quantitatively | 3.56% |
| | 100.00% |

**(1) Colour and Flavour.**

These vary with every species of flower. Light colour usually goes with mild flavour, while dark colours are associated with the more strongly flavoured honeys. The light-coloured honeys, as a general rule, command the highest price.

Dandelion honey is increasing, and where a considerable surplus is noted it should be removed at the beginning of the clover flow. If it is not ripe place it above the empty super with a queen excluder below it. This will prevent the mixing of honeys. The dandelion honey should be extracted and sold separately or kept for spring feed. It is well to force the bees to ripen the clover honey when the wild buckwheat and wild sunflower are about to yield in the fall, if they are abundant, otherwise all the honey will be dark and the clover flavour masked. Placing the empty supers above the partly filled ones a week before the wild buckwheat and wild sunflower yield, instead of next to the brood nest, will usually accomplish this.

**(2) Body or Density.**

When nectar is brought in from the field it contains from 40% to 80% of water. The bees reduce this to 17% or less in well ripened honey. The less water the greater the body, or density, of the honey. Honey having over 19% of water may sour or ferment, and is said to be "green." Honey of a minimum specific gravity of 1.420 will not ferment if kept in a dry place. Capped honey is usually ripe, but the capping is not water tight. In damp places water will be absorbed by the honey through the capping, and fermentation may take place.

**(3) Crystallization.**

All honey will crystallize (or granulate) in time. E. J. Dyce, O.A.C., Guelph, has made a careful study of the crystallization of honey and finds:

1. The quality of granulated honey, from the standpoint of human taste, depends on the size of the crystals, and honey with large coarse granulation is inferior to that with small crystals.
2. Practically all honey will granulate below a temperature of 86 degrees Fah. unless prevented.
3. Granulation is most rapid at about 57 degrees Fah. Contrary to general belief, fluctuating temperatures and low temperatures do not hasten granulation.
4. Honey from extracting combs which were not cleared by the bees in the fall granulates more rapidly than that from cleaned combs.
5. The use of honey pump hastens granulation.
6. Heating honey retards granulation and often causes coarse granulation.
7. The rate of granulation depends partly on the source of the honey. The more levulose present, the slower the granulation.

**(4) Fermentation of Honey.**

Honey having less than 17% of water will not ferment if stored in a dry place. Properly ripened honey is a highly concentrated solution of sugars. As long as all remain in solution no yeast or mould is able to grow in it. Dextrose, however, crystallizes out first and requires a very small amount of water for crystallization. This leaves the other sugars in a more dilute solution and if the air is moist the concentration is reduced in time to the point where certain sugar-tolerant yeasts can grow. For this reason every care should be taken that the honey is well ripened before extraction.

In the case of "green" honey (honey taken from uncapped combs which the bees have not ripened) fermentation takes place rapidly. The honey has a tendency to separate out into layers. A sour, watery solution floats to the top and fermentation is usually rapid. Such honey is usually a total loss. To avoid the fermentation of honey, beekeepers commonly do not extract the combs until at least two-thirds capped in the North and one-third to one-half capped in the South, and always keep both the combs and the extracted honey in a dry place.

The only certain means of knowing the percentage of moisture is by using a honey hydrometer. The one approved by the Fruit Branch may be obtained from the Hughes-Owens Company of Canada or their accredited agents. The cost is approximately $8.00.

**Honey-Dew.**

Honey-dew is the sweet excretion given off by plant lice, or aphids, scale insects and leaf hoppers. It contains little invert sugar and a high percentage of gums. Honey-dew is gathered by bees when nectar is not available. It is most unsatisfactory for wintering, but can be used for brood rearing in the spring.

Honey-dew has a smoky flavour, and being unprotected on the trees, picks up dust and other impurities. It is dark in colour and granulates very slowly.

## GRADING OF HONEY

The regulations governing the grading and shipping of honey are incorporated in The Fruit, Vegetable and Honey Act. This is administered by the Fruit Branch, Ottawa. A copy of the Act and its regulations may be obtained from the Fruit

Branch, and should be in the hands of all commercial beekeepers, since they must compete with graded honey in Alberta markets, even if they do not ship outside the Province.

Mr. F. R. Armstrong, Honey Specialist with the Fruit Branch, writes in a letter discussing the Act as follows:

"Regulations under the Fruit, Vegetables and Honey Act (Revised 1937) require the classification, grading and marking of all honeys shipped export or interprovincially. The regulations also require the annual registration of all persons who engage in the assembling or shipping of honey for export or interprovincial trade, with the Fruit Branch, Department of Agriculture. The fee for registration is $1.00 per annum, but in the case of persons shipping only honey of their own production, registration is renewable without fee upon application to the Fruit Commissioner, provided the original registration has not been allowed to lapse."

Anyone grading their honey will require the honey hydrometer to determine the moisture content, and a honey grader or classifier to judge the colour of the honey. The latter costs about $3.75.

**The following Regulations affect all producers of honey:** The name of the product, i.e., "honey", the name and address of the beekeeper or packer, and the net weight, shall appear on the labels of ALL HONEY CONTAINERS regardless of where it is sold in Canada. The above regulation applies to cut comb and "sections" as well as extracted honey in pails and other containers.

## SECTION IX.

## BEESWAX

Beeswax is an important product of the apiary, too often neglected by the beekeeper. The practice of carrying a small pail while inspecting colonies and putting all bits of wax removed during examination into the pail, putting on the lid, and rendering the wax as soon as convenient, is most commendable. At times, enough beeswax is secured in this way to almost pay for the labour cost of the examination, and during the robbing season a bit of comb containing honey may, if thrown near a hive, cause an orgy of robbing.

**Rendering Wax.**

Wax is prepared for market by melting, straining and putting in a mould where it cools slowly. Certain precautions are necessary if one is going to obtain a quality product, for shipments which have been simply melted with no attempt at cleaning, and which are a mixture of wax from all sources, have been docked two-thirds of the weight.

Wax should be heated (but not boiled) in soft water in a deep receptacle so the wax which rises can be readily dipped out. Old combs should be broken and soaked in cold water over night before rendering, and all wax should be put in sacks (clean burlap is usually used) so the cocoons will not float up into the melted wax. The sacks should rest on a wooden rack and be weighed down with stones or other means, which will prevent flating. As soon as the wax is melted let the fire die down. This will allow the water and any dirt to settle out. If the wax cools too quickly it will be mealy. Just before the wax begins to harden dip it out into clean containers with flaring sides. This will make the cleaning of the bottoms of the cakes unnecessary. Usually wax at this stage does not stick to clean wood or tin, but by wiping over the inner surfaces of moulds with honey or soapy water all danger is avoided. Be careful not to stir the wax while dipping it out, and so introduce water. Place the pails containing the wax where they will cool slowly to prevent checking. The lower two inches of wax on the water will be dirty, and the cake which it forms can be kept and re-melted with the last cakes of the other batches.

The slumgum left in the sacks consists largely of cocoons and wax. Commercial men are well advised to use wax presses, and salvage this wax. These are described in all bee books.

**Quality.**

The finest wax is obtained from cappings, and is a lemon colour, the poorest is from comb scrapings, which usually contains much rosin, and tends to be orange in colour. Wax which has been overheated will contain burnt pollen, which gives it a black colour. Such wax is more useful than its appearance would indicate, but of course will be heavily docked. The beekeeper is well advised to melt his wax cappings and comb cappings separately. The rosin will not separate out from the comb scrapings, and the orange coloured wax obtained will be sticky. It cannot

be used for foundation, as it stretches and flows, but it has a market value. Orange coloured wax is sometimes used for incense candles, but it sputters in burning. More frequently it is cut into inch squares thrown on to the fires in an open grate, or melted and poured over gunny sacks, which are then rolled and cut into lengths and used in the smoker.

Use rain water when possible. Alkali water saponifies wax and, if used, the underside of the cake of wax will be spongy and full of water. Do not quite fill the can or boiler used to melt the wax in. When the wax is reasonably clean, enough water to cover the sacks containing the wax to a depth of 2 or 3 inches is sufficient.

**Cleaning Utensils.**

Drop wax covered utensils into boiling water, and when the wax has risen to the surface, cool by adding cold water. When the wax has formed a cake, the utensils may be removed. Wax may be removed from large surfaces or dishes by heating and wiping off with newspaper. Gasoline, benzine, ether, and solutions of sal soda are effective in removing wax. The usual care should be taken when dealing with the highly inflammable solvents.

**Custom Rendering.**

A number of firms will render old comb and cappings at very reasonable rates. Often they buy it outright, or return foundation in trade. All shipments should be labelled "Beeswax refuse" to get the special shipping rate. It does not pay to send shipments weighing less than fifty pounds.

## SECTION X.

## WINTERING BEES

Winter is the most critical season in the life of the colony. While we believe bees can be successfully wintered in any section of the Province, we strongly urge the killing of all colonies lacking in young bees, proper stores or protection. Often colonies will survive, but the mere fact that there are bees in the colonies in the spring does not mean that they have wintered successfully; they may just be a long time dying.

A beekeeper should prepare for winter as carefully as he builds up his colony for the flow. Where this is not possible, he must at least examine his colonies during the last week in August and destroy any colony which is a poor risk. It is true that in certain years almost any colony will winter, but over a period of years the "taking of a chance" is poor business.

**Bees in Winter.**

Bees defend themselves against the cold by clustering when the temperature drops to 57 degrees Fah. They gather on dry combs, a bee enters every empty cell, and the others with their heads facing inwards retain the heat, by crowding together. The long hair of their bodies helps greatly in preventing the rapid radiation of heat from the individual, and when the bees are close together forms an almost felt-like mat. The cluster takes on a spherical form, and is usually found near the entrance in the fall. As the honey adjoining the cluster is used, the bees work back and up into the hive.

As the temperature drops the bees in the centre of the cluster produce heat by muscular movements. Such heat production is a severe drain on the physical resources of the bee, and if the demands are very great, or if many of the bees have seen service as field bees, the colony will be found dead with considerable brood in the cells covered by the cluster, or will dwindle in the spring.

**Young Bees.**

A colony with six frames of young bees has an excellent chance to winter, given food and protection. Field bees increase the risk by their restlessness, consumption of stores, and the tendency to raise the temperature of the hive during weather just too cold for flight.

Nuclei composed of a queen and three or more frames of brood with adhering bees, established during the last of July or the first of August, will develop sufficiently to form excellent wintering risks in seasons of normal honey flows. Such nuclei may need feed, and should never be expected to produce a surplus of honey.

A second and more common method is to leave the supers on the old stand and move the brood chamber back 100 feet, giving it a new cover and bottom board, and reducing the entrance. The old bees fly back to the old stand. The bees in the brood chamber are wintered. If there are not enough to cover six frames on a cool

morning after the brood has emerged, it should be united with some other, but of course no attempt should be made to winter by reuniting with the bees on the old stand, which should be killed as soon as the flow is over. If the beekeeper has only one colony and finds there are not enough bees in the moved brood chamber, kill the bees as soon as all the brood has hatched.

The time for the above manipulation differs with the season. If the honey flow cuts off smartly around the middle of August such a separation will not be necessary, as the fielders will die before the colony is confined by cold to the hive. If a year of slow, late flow, make the division while there are 4 to 6 frames of brood in the hive.

**Stores.**

Each colony should have from 45 to 50 pounds of honey or sugar syrup in the hive. A hive ready for winter weighs from 75 to 90 pounds. Colonies should be fed as soon as possible after the flow, and no attention should be paid to a dribbling mid-September flow. Colonies cannot be fed till brood-rearing is at an end. This may be hastened by the separation of the old and young bees as outlined above.

Early feeding prevents the wastage of bee energy in a vain hunt for nectar to fill up the brood nest. It prevents the storage of honey-dew or late fall honey with much indigestible matter, and makes possible the packing of bees for winter in fine weather.

**Protection from Low Temperatures.**

A cluster of bees is like a furnace in that it produces heat and keeps the air in the house, or rather in the hive, at a higher temperature than the air outside. The better the insulation in the walls, the less the demand on the furnace, and it naturally follows that a colony in a hive placed in a rainproof wintering case, and properly packed with ground cork, planer shavings, hammered straw, leaves, etc., should come through the winter in better shape than one not protected.

The thickness of the packing required is a much debated question. If the temperature of the hive remains at about 57 degrees Fah., the bees are saved much labour. Should a mild spell come on in early mid-winter, the bees may raise the temperature, especially if the food is not all that could be desired, and the queen will lay eggs. Whether this is due to excessive packing is doubtful. There are other factors which may cause the trouble, such as food, age of bees, etc.

At any rate the orthodox packing is six inches below the hive, four to six inches on the sides, and a foot of hammered straw on top. A tunnel leading out from the hive, which is open at all times, is essential. The opening in the packing case may consist of five auger holes, or a slit ⅜ of an inch high by 5 inches long. This may be reduced in severe weather to two auger holes, or when the slit is used to ⅜ of an inch by 1 inch. No ledge should be present below the entrance on which ice may form. Snow should be welcomed.

**Fig. 15.—A Gem apiary protected by willow boughs woven through a barb wire fence. Note how earth is banked to keep willows upright.**

**Windbreaks.**

Placing bees in wintering cases after the cluster is formed may induce harmful activity. Put the packing case in place as soon as the queen stops laying. Many remove the hive cover for winter, leaving the queen excluder and three or four thicknsses of sacking, or a pad filled with shavings or hammered straw, in its place. This prevents the accumulation of moisture.

When packed, the bees should be left alone until spring. The removal of ice in the entrance or of dead bees from the entrance, once or twice during the winter with a hooked wire should be the only possible reasons for going near the bees until the spring.

Dr. Philips says that a packed hive exposed to a wind blowing at the rate of twenty miles an hour will be as cold in five hours as though it had not been packed. A windbreak of trees or a slatted fence then is as important as packing.

**Cellar Wintering.**

Cellar wintering is regarded as far more difficult than outside wintering. The bees must not be exposed to a long period of cold in the fall before being placed in the cellar, even if this results in their being put away before Nov. 15, the usual date. Spring protection is usually necessary to prevent spring dwindling, unless excellent windbreaks surround the apiary.

Bees have been successfully wintered in all kinds of cellars that were kept absolutely dark, and in which the temperature did not rise above 50° or fall below 40°. A temperature of 32 degrees Fah. is usually fatal unless the hive entrance is reduced.

Very strong colonies do not winter well. Usually they contain old bees, and unless the bottom or cover of the hive is removed the temperature within the hive goes well above 57 degrees. Small nuclei composed of young bees with good queens and excellent stores will winter well if the entrance is reduced, even if the cellar is cold. The essentials of successful cellar wintering are:

(a) Young bees. (Colonies covering 6 frames are ample if there are few fielders.)

(b) High grade stores. Give at least 20 pounds of sugar syrup early enough to let the bees store it properly.

(c) A constant temperature that does not rise above 50 degrees.

(d) Complete darkness and non-disturbance.

Keep an accurate thermometer in the cellar and introduce it into the entrance of the hives from time to time.

Enlarge or reduce entrances as temperature or strength of colonies demand. Use a red light in the bee cellar. If the weather is exceptionally fine during February and there is no snow, carry the bees out for a flight from 9 a.m. until 5:00 p.m. Do not leave out over-night. If the bees get very noisy and the cellar too dry, soak the floor with water. If the temperature rises too high during the day open the cellar door at night to cool it off and close it before morning.

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We wish to express our thanks to B. H. Backus for the cuts illustrating the equipment in this booklet.

## PUBLICATIONS OF INTEREST TO BEEKEEPERS

A. B. C. and X. Y. Z. of Beekeeping—Published by A. I. Root & Co., Medina, Ohio, U.S.A.

This is the encyclopedia of Beekeeping. It deals with all phases of management, and usually gives several methods. If you can afford only one book, get this one.

How to Succeed With Bees—Published by G. B. Lewis Co., Waterton, Wis., U.S.A.

The authors of this book, Atkins and Hawkins, have had considerable experience with commercial apiaries. The system outlined is excellent and readily understood.

**Bee Journals—**

The Canadian Bee Journal—Lakeside Publishing Co., Oshawa, Ont.

Western Canada Beekeeper—Winnipeg, Man.

The American Bee Journal—Hamilton, Illinois, U.S.A.

The Journal of the Central States. Tends to stress the science and research in beekeeping in a popular way.

Gleanings in Bee Culture—Medina, Ohio, U.S.A.

Greater number of leading articles by practical apiarists of the Eastern States.

Bees and Honey—Alhambra, California, U.S.A.

The Bee Journal of the Western Coast.

**Bulletins—**

These bulletins deal with the problems of beekeeping as they affect the beginner, and are usually well illustratd.

Bees and How to Keep Them—By C. B. Gooderham—Publications Branch, Department of Agriculture, Ottawa.

**Wintering—**

Wintering Bees in Canada—By C. B. Gooderham, Bulletin No. 74—New Series, Publications Branch, Department of Agriculture, Ottawa.

**Disease—**

The outstanding work on bee diseases has been done at Washington ,D.C. Write Division of Publication, U.S. Dept. of Agriculture, Washington, D.C., for Bulletins on American Foul Brood, Sac, and other diseases. The usual price is 10c.

**Comb Honey—**

The authority on the production of comb honey was George S. Demuth. His Bulletin, "Commercial Comb-Honey Production," can be obtained from the U.S. Dept. of Agriculture, Washington, D.C., as Farmers Bulletin 1039.

## DEPARTMENT OF AGRICULTURE PUBLICATIONS

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The above bulletins may be obtained from:

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